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Surgery, Gynecology and Obstetrics

WITH

International Abstract of Surgery

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Fig. 4a.

Fig. 4a.

Fig. 4c.

Fig. 4c.

Fig. 4c

Fig. 4b.

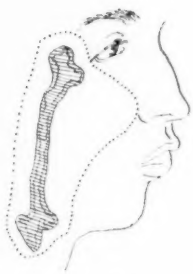
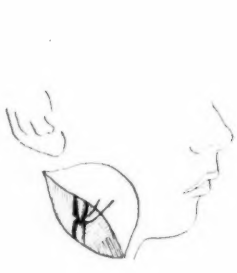


Fig. 4b.



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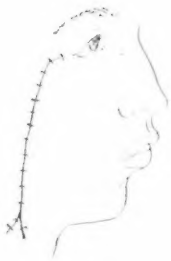

Fig. 4b.

Fig. 4d.

Fig. 4d.

Fig. 4d.

Fig. 4d.

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XXXIV JUNE, 1922 NUMBER 6

RECONSTRUCTION SURGERY OF THE FACE[1, 2]

BY V. P. BLAIR, M.D., F.A.C.S., ST. LOUIS

IT is not generally recognized that, on the average, larger facial defects are created in the treatment of cancer than by battle casualties. These and punitive mutilations, have made plastic surgery of the face one of the earliest types recorded. Long before the war, its possibilities were beginning to take on concrete expression, but to date the encomiums that have been showered upon it are at least partially dependent upon comparison for their justification.

The most important part of any surgical procedure is a plan, and the more closely and intimately this plan fits the needs of the case, the better will be the result. In reconstruction of the face, the plan should be as accurate and comprehensive as those used by the occulist, the dentist, or the journeyman tailor. In the creation of the plan, we should mimic the methods of the sculptor or the tailor who materializes his conceptions in clay or paper before attacking the marble or cloth. If reconstruction surgery of the face should continue to develop along the lines upon which it is well started, I can see no reason why, in the majority of cases, given a healthy patient and a really good surgeon (who must have the feeling of an artist, the skill of an ordinary tailor, and the tenacity of a rat-terrier), there should not be produced in flesh and bone features that compare favorably with those created by the accepted sculptor or painter; but it will require skill and training and no end of hard work. Until such men are trained to work in this line, the results must continue to be archaic and not incomparable to those that would follow if each man here were from now on forced to make his own clothes. Some would do better than others and certain individuals would attain to comparative skill but it is probable that there would not be one first-class tailor in the entire number.

Satisfaction with one's appearance has a tremendous bearing on poise and self-confidence. Disregarding battle casualties, skill in the correction of facial defects will open up a very substantial field of legitimate and much needed surgery.

In the making of the plan, the most important single thing to be regarded is that the value of facial balance far outweighs that of any individual feature. When preserved or restored, it has saved many a result that had little else to recommend it and when lacking will seriously mar the best technical efforts.

Mars feels that he has done enough for surgery when he furnishes the victims and has always frowned upon the interruptions incidental to treatment, but in spite of this, through the kindly analysis given by our late friend, General Gorgas, and the characteristic "Go to it," which was the response

[2] Being a record of the treatment of certain battle casualties, in the United States Army General Hospital No. 11 and at the Post Hospital at Jefferson Barracks, in association with Major Frank Tainter, M.C., Captain George Cross, M.C., Captain Lee Cohen, M.C., Captain N. H. Horni, M.C., Captain J. H. Dyer, M.C., Captain F. J. Moeninghoff, M.C., Captain E. J. Dameron, D.C., Lieutenant D. H. McCauley, D.C., Lieutenant B. H. Worthley, D.C.

[1] Presented before the Clinical Congress of American College of Surgeons, Philadelphia, October 26, 1921.

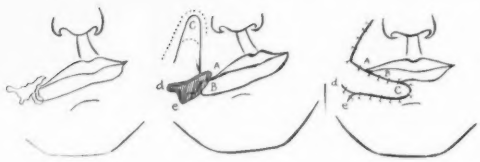

Fig. 1a.

of General Ireland to any worth-while proposition that seemed feasible, the planning of facial operations received a tremendous impetus in this country by the use of the artists, sculptors, and photographers which the army furnished to co-operate with the surgeon in all stations especially designed for this work.

I want to take advantage of the opportunity you have given me this evening to present a few types of facial cases that have been treated in the army, and do this both as a tribute to the consideration this work received from the medical and dental departments at large, and also to record possibly a comparatively early stage in the future development of this work.

Figures 1a and 1b show scarring from shell wound that destroyed parts of cheek, chin, lower lip, and a section of the lower jaw. In the repair of the soft parts the chief scars in the cheek were excised and tissues undermined until the skin could be smoothly sutured without a depression. A flap was cut from the cheek adjacent to the lip and nose. The part of the flap above the dotted line included skin and some subcutaneous tissue, below the dotted line the full thickness, including the mucosa, was taken with the flap. An incision was made along the mucocutaneous junction, bordering the defect and the mucosa dissected up so as to permit the implantation of the flap.

Figures 2a and 2b. Simple excision of a broad scar and repair of the defect. Where the scar is irregular in shape it is desirable so to plan the excision that the least possible amount of good skin will be sacrificed. These pictures illustrate such a procedure. Before attempting to draw together the borders of the wound, the surrounding tissues are undermined as far as the dotted line so that they can be approximated without tension. In this situation the undermining is made just superficial to the periosteum.

Figures 3a, 3b, and 3c. 3a, Shows the result of a deep oblique cut made by a shell that destroyed the eye and lower eyelid and allowed the cheek and corner of the mouth to slump down. The injury did not involve the bone. 3b, Shows the plan of repair. At the first operation the scar area was excised (indicated by oblique shading) and the tissues undermined to the extent indicated by the dotted line. Above and external to the excised scar the plane of undermining was made superficial to the buccal and temporal fasciæ, while below and in front of it the soft tissues were raised from the bone. The lower flap was made to overlap the exposed buccal and temporal fasciæ and sutured in place. This filled the defect and raised up the cheek and corner of the mouth. At a subsequent operation Captain George Cross, M. C., U. S. A., after separating the mucosa from the skin surrounding the lower eyelid defect switched in a temporal flap to replace this eyelid. 3c, Shows the result of the first operation. The line of dots across the cheek show spots of pressure atrophy due to the buttons holding deep tension sutures. 3d, Eyelid in place. This is a photograph of the patient after completion of his case.

Figures 4a, 4b, 4c, 4d. 4a. A shell wound through the full thickness of the cheek and body of the mandible which has partially healed with the cheek tissues slumped downward. A relatively small, sharp-edged

Fig. 1b.

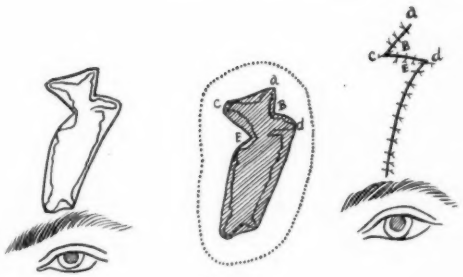

Fig. 2a.

piece of shell spinning around like a circular saw could cut a very deep and wide gash in the tissues.

Figure 4b. Diagram illustrating scheme of correction. The first figure in the drawing represents the condition on return from overseas. The shading in the second figure shows the plan of scar excision which went completely through the cheek into the mouth. The dotted line shows the extent of the deep undermining which was just superficial to the bone, while there was a less extensive plane of undermining done bewteen the skin and the muscle. Note the conservative manner in which the scar excision was done and how the external canthus as well as the whole cheek was raised by the suturing. In suturing, the buccal mucosa was approximated with tannated gut and the intermediate tissues were overlapped with plane gut for the double purpose of elevating the cheek and corner of the mouth and of filling out the thickness of the cheek. This latter line of sutures was reinforced by deep mattress, silkworm-gut stay sutures which were tied over rubber tubing or buttons on each side of the wound. Skin was closed with interrupted horsehair. The depth of the wound was freely drained with rubber dam strips both on the buccal and external surfaces. This latter step is important. Such wounds are always soiled and have irregular spaces in their depths that cannot be immediatly obliterated to advantage. It is my observation that the blood clot can play only a sinister rôle in plastic surgery. The third figure in the drawing shows the preliminary ligation of the external carotid artery as a means of limiting hæmorrhage. A temporary control of the opposite common or external carotid is usually of further advantage. In the Casualty Clearing Station it was a notable fact that wounded soldiers bled very little at the first operation and even with large *débridements* few ligatures were necessary. At later operations, however, the conditions are reversed, and the hæmorrhage from excision of scars becomes so excessive as often to threaten life, if very careful preventive measures are not employed. The mere use of hæmostatic forceps is not sufficient, for in many of these cases, forceps cannot be placed sufficiently close together to control all the bleeding points. The fourth figure in Figure 4b shows the wound sutured.

Fig. 2b.

Figure 4c. The roentgenogram to the left shows the defect in the body of the lower jaw corresponding to the cheek cut. Note that the ramus is drawn forward, which has lessened the apparant extent of the defect. The sliding pedicle graft was taken from the lower border of the mandible and fastened in place with wires which were left protruding through the surface wound to provide drainage. A supplementary drain was placed in the most dependent part of the wound, not in contact with the bone. The mouth was accidentally opened during the procedure. This is a routine precaution against the blood clot which some operators court. The roentgenogram to the right shows the bone graft grown solid. During the healing process, both jaws were fixed by a splint made by Captain Dameron, D.C., U. S. A.

Figure 4d. Profile and full front views of the case showing condition at the time of operation and at discharge from the hospital. Note that the external canthus, the corner of the mouth, and the cheek have all been elevated.

Figures 5a, 5b, 5c, 5d, 5e, and 5f. Figure 5a. Drawing of case in which most of the injury was confined to the inside of the mouth, destroying the lining of the right cheek, a section of the body of the mandible and some of the full thickness of the cheek near the angle of the mouth. The malar bone was fractured and pushed outward which resulted in cheek bone and zygoma being more prominent. The first step in the operative treatment was to restore the lining of the cheek and also the skin about the corner of the mouth. This was done by removing all of the scar and then cutting a long flap from the neck and chest which was drawn into the mouth through an incision in the lower buccal fornix, and the tip of the flap was drawn out through the oral fissure and sutured into the external cheek defect, as shown in the central drawing. Twelve days later the pedicle was cut and the base of the flap returned to the neck. The figure to the right shows the amount of the flap that was left in the cheek.

Fig. 3a. Fig. 3c. Fig. 3d.

Fig. 3b.

Figure 5b. The photograph to the left shows the condition immediately after the long flap was sutured in place. The defect resulting from removing ing the flap from the neck and chest has been obliterated by undermining and drawing the edges together. The lower end of this sutured wound, the depth of each pocket in the neck resulting from the undermining, and the potential pocket resulting from the twist made where the flap turns on itself to enter the mouth and the space between the flap and the cheek are all drained by rubber dam drains which have been sutured in place. The latter two of these drains are of particular importance in cases in which the parotid gland is still active. In many it seems to have been destroyed by obstruction of the parotid duct by scar. The photograph to the right shows a later condition when the flap has healed in place and is forming the lining to the cheek. Skin so turned into the mouth usually behaves very well, becoming pink in color and rather closely resembling mucous membrane. Occasionally, when redundant, it rises into folds formed by the scar base and requires partial excision. If it is hair-bearing, the hair will continue to grow and will require trimming until it is destroyed by radium.

Figure 5c. The roentgenogram shows the repair of the bone defect which was closed partly by a sliding bone graft made from the lower end of the ramus and partly by an outgrowth of new bone which was formed as the two ends of the bone were slowly separated by a traction splint. This gradual separation of the ends restored the jaw to its normal occlusion, the potential gap being filled with new bone which formed concurrently with the separation of the fragments. The roentgenogram also shows the gap in the ramus where the subcutaneous saw cut was made and shows the bar of new bone that helps to bridge the gap.

Figure 5d. The photograph to the left shows the soft parts repaired but abnormal width of the right side in the malar region still persists. To determine the exact amount of this increase, a plaster cast was made of each side of the face, and the left cast was built up with clay until it was of the same prominence as the right. The piece of built on clay was then cut through to determine its depth. This piece showed the amount

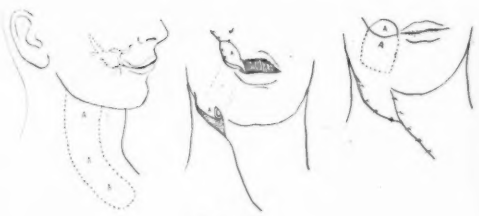

Fig. 5a.

that had to be removed from right cheek bone to make it correspond to the left; the normal side.

Figure 5c. The photograph to the left shows distortion of cheek and mouth, original condition.

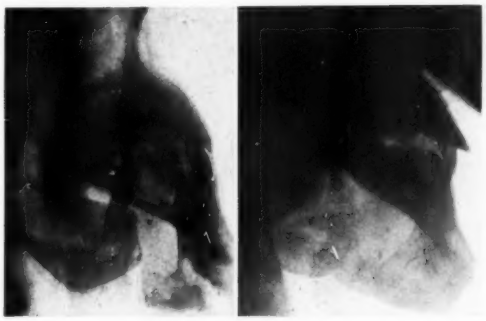

Fig. 5c.

Fig. 5b.

Fig. 5b.

Fig. 5d.

Fig. 5d.

Fig. 5e.

Fig. 5e.

Fig. 5f.

Fig. 5f.

The patient at that time had the posterior part of the body of the right mandible drawn forcefully against the palate. The photograph on the right shows the condition when the patient was discharged from the army. The jaw bone is solid and he can open his mouth freely.

Figure 5f shows the lateral aspect taken at times corresponding to Figures 5e.

Figures 6a and 6b. Illustrates a case in which a large opening in the anterior part of the palate, caused by piece of shell, was repaired from a skin-covered pedicle flap taken from the front of the

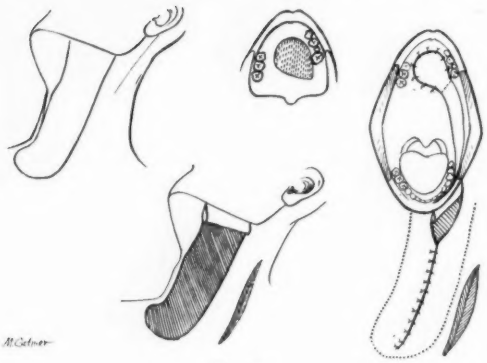

Fig. 6a.

chest. The upper left hand figure shows schematically the flap outlined; the upper central figure, the opening in the palate; the lower central figure, the flap turned into the mouth through an opening in the inferior buccal fornix with a relaxation incision posterior to the defect in the neck. The figure to the right shows the flap sutured into the palate defect and the neck defect closed by drawing its borders together. The next step would be to cut the pedicle of the palate flap at the palate border, freshen its granulating surface, and, after reopening the upper part of the healed neck wound, suture the pedicle back into the neck. This is shown in Figure 6a. The relaxation incision will close of itself. Later these rather rough scars can be excised and more exact approximation made by careful suture. Even the scars can be further improved by the use of radium, but a vertical scar in the neck will always be visible.

Figure 6b shows photographs of the condition in various stages. In the one to the right, as yet no attempt has been made to improve the neck scar, and the flattening of the upper lip is due to lack of teeth, later corrected by a denture. In the middle photograph the patch in the palate forms a rather prominent pad which later, with the use of a dental plate, flattened to conform to the general contour of the palate.

Figures 7a and 7b. Figure 7a. Diagramatic illustration of the correction after the lower lip and most of the covering of the chin had been torn away by a piece of shell. Scar contraction had drawn the neck tissue up over the mandible until much of the original defect had become covered, as shown in the right upper illustration. The excision of the scar left the defect shown in the left upper figure. From the lower point of the "V," on each side an incision was made to the bone downward and outward to the lower border of the mandible and then back to the anterior border of the masseter muscles, the flaps being dissected entirely free from the periosteum. A corresponding incision was made through the mucosa along the inferior buccal fornix. At the posterior extremity, this horizontal incision in the mucosa turned sharply upward to end just beneath the opening of the parotid duct. This vertical part of the intra-oral incision went through, not only the mucosa, but the buccinator muscle and buccal fascia. The anterior part of each of the two cheek flaps thus mobilized was rotated upward until the edges that formed the lateral borders of the "V," were made to form the free border of the lower lip. By the incision described and some undermining in the submucous tissue, the buccal mucosa had been sufficiently freed to permit of its being drawn over the raw surface on the border of the new lip and sutured to the skin, thus making a vermillion border. Suturing these flaps to the tissue on the point of the chin that had become fixed there by scar, in turn fixed these flaps in their new position. Originally there had been some loss of tissue in the left cheek below and external to the corner of the mouth. Including this last mentioned scar in the excision, made the left arm of the "V," longer than the right which accounts for the fact that more of the lower lip was fromed from the left flap than the right. With this, however, there was a corresponding deficiency in the vertical extent of the left half of the lip near the corner (central Figure 7b), which was compensated for by the flap "A" taken from the junction of the cheek with the upper lip. The lower left figure shows

Fig. 6b. Fig. 6b. Fig. 6b.

the flaps sutured in place. The artist has used some poetic license in portraying the outline of the vermillion border. The lower right figure is a good representation of the lateral aspect of the case when finished.

Figure 7b. The left photograph shows condition when the case reached reconstruction hospital in this country. Central figure shows condition after large cheek flaps were brought into place but before the small upper "A" flap was turned down. Right figure shows the completed case.

Figures 8a, 8b, 8c, 8d, 8e, 8f, 8g, 8h. Figure 8a. The right hand figure is a diagramatic reproduction of a roentgenogram of a case in which a shell passed through both cheeks, splintering the body of the mandible on both sides and tearing a large hole of exit on the right side. Owing to the press of war conditions, neither proper fixation nor drainage was established at time of injury, and this, added to lack of special care in subsequent evacuations, permitted of extensive necrosis of the bone and loss of all teeth in the remaining chin fragment. When he arrived at a reconstruction hospital 10 months after injury, there was a loss of the body of the mandible from the second molar to the cuspid tooth on the left side, and the lower half of the ramus and the body so far forward as the cuspid tooth on the right. There was union on neither side and no teeth in the chin fragment. The teeth in the upper jaw were good. Captain Daniel McCauley, D.C., U. S. A., and Lieutenant B. W. Worthley, D.C., U. S. A. constructed an aluminum splint to embrace all of the upper teeth and palate, having a protruding bar which extended forward to a distance of 3 inches in front of the incisor teeth. On the left side, the ramus was subcutaneously cut in two transversely by a wire saw, and the ends of the body bordering the defect on that side were freshened and wired together, after the newly constructed jaw was pried and dragged forward. Two heavy wires were pressed around the mental fragment and fastened to the end of the bar on the splint, or rather to a downward extension of this bar which brought the line of traction into the plane of the body of the mandible. The figure also shows: (1), the cut in the ramus;

Fig. 7a.

(2), the posterior body fragment including the angle dragged forward; (3), the wire uniting the two fragments with its twisted ends protruding for drainage; (4), the two circumferencial traction wires passing about the mental fragment. The photograph at the left shows an external view of the splint and wires and the scar due to loss of tissue on the right side of the face. The strain on the splint was so great that it caused pain and threatened the anchorage of the upper teeth. To relieve this the patient was put to bed and a counter weight was applied to a cord which was attached to the bar of the splint and passed over a pulley block in the ceiling, as shown in Figure 8b. After a week or 10 days this weight

Fig. 7b. Fig. 7b. Fig. 7b.

Fig. 8a.

Fig. 8a.

Fig. 8e.

Fig. 8e.

Fig. 8b.

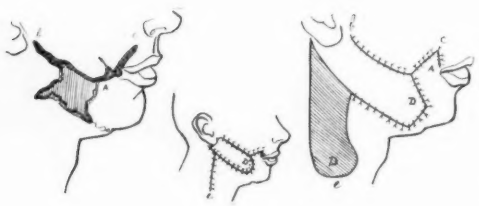

Fig. 8c.

Fig. 8f.

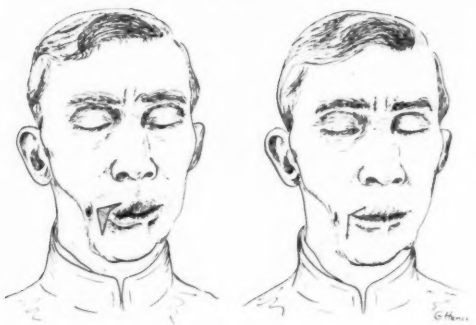

Fig. 8d.

extension was dispensed with. The next operative step was excision of the scar and the transfer of a flap from the side of the neck to the cheek, as shown in Figure 8c. An attempt was made to plant a piece of rib into the site from which this flap was to be obtained, but owing, probably, to an injury of

Fig. 8g. Fig. 8g. Fig. 8h. Fig. 8h.

the parotid gland, there was necrosis of tissue and the rib had to be removed and transfer of the flap delayed.

Figure 8d shows a plastic operation that was done to correct the sphincter-like appearance of the right corner of the mouth. The shaded area in the left hand figure was excised through the full thickness of the cheek, and the wound closed, as shown in the right hand figure. Figure 8e shows the results obtained by the operations thus far described.

Following the plastic on the right cheek, a Gillies bone-cartilage graft was placed in the defect in the right side of the mandible. One-half inch of the tip of the left ninth rib and almost all of the cartilage, which makes a sharp angle, was removed and the rib part was united to the freshened left end of the mental fragment while the sternal end of the cartilage was buried in a tunnel burrowed between the soft tissues and the external surface of the remaining part of the ramus. This operation had to be performed in two steps. After preparing the bed to receive the graft, to avoid using the great number of ligatures that would be needed partially to control the bleeding, the wound was closed with 24-hour drainage and about a week later it was re-opened and the graft inserted.

Figure 8f. The figure to the left shows the cartilage-bone graft replacing the right body of the mandible. The cartilage is visible in the roentgenogram because of lime deposits. When first seen it was thought that this might be due to the change of function, but an X-ray of the chest showed all cartilages similarly affected. Comparing the right figure of 8f, with the right figure of 8a, there seems at first glance, to have been an apparent lengthening of the reconstructed body. Careful comparison leads to the conclusion that this is an actual lengthening due to the ramus, which was dragged forward at the time of operation, gradually retreating to its normal position with a concurrent deposit of bone at the site of union, the mental fragment being fixed at the time by the splint. The roentgenogram shows that the mental fragment has not materially changed its position. Such a deposit of bone at the site of a mandibular fracture, when the fragments are gradually drawn apart by a traction splint, has frequently been observed and quite large gaps have been made to fill in by this procedure.

Figure 8g. Front views of this patient which were taken to show the condition of the patient at the time of entering the reconstruction hospital and at the present time.

Fig. 9a. Fig. 9a. Fig. 9b. Fig. 9b.

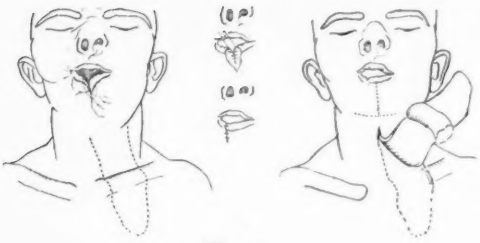

Fig. 9c.

from the serious objections that have been raised against infiltration of tissues with the melted wax.

Figures 9a, 9b, 9c, 9d, 9e, 9f, 9g. Figure 9a. Photograph to the right shows a man in whom the right two-thirds of the upper lip, the lower half of the right cheek, the greater part of the lower lip and chin, and all of the mandible in front of the second molar teeth were destroyed by a shell fragment. The first step in the reconstruction was to cut the ramus in two, transversely on each side, and slide the remaining part of the body and angle of each side as far forward as possible where they

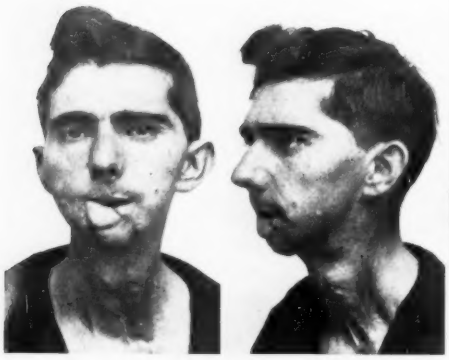

Fig. 9d. Fig. 9d.

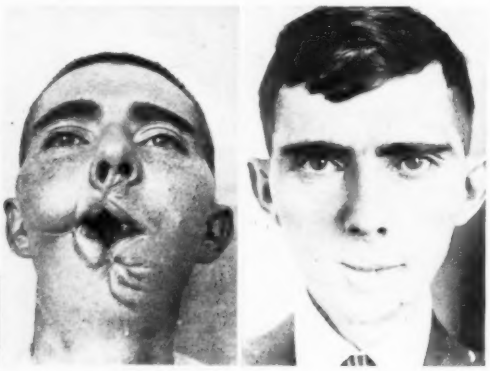

Fig. 9e. Fig. 9e.

Fig. 9f. Fig. 9f. Fig. 9g.

Figure 8h. Profile views of same patient. The scars resulting from the plastic operations have been excised and resutured. An inlay graft (Waldron type) was used to deepen the inferior dentolabial fornix. The chin has been rounded out with a deep injection of cold paraffin because the patient wished to avoid another such a serious operation as a cartilage graft (see Figure 9f). In spite of the prevalent and wise prejudice against its use, I believe that the injection of cold paraffin in a solid mass is free

were retained by a contrivance made by Captain Dameron. In this way about seven-eights of an inch in the length of the body of the jaw was gained on each side. This procedure is shown in Figure 8a. The second step was to reconstruct the upper lip by cutting the flaps "A" and "B" through the full thickness of the cheek, and, after freeing the distorted floor of the right nostril, these two flaps were rotated downward and sutured in place forming the upper lip shown in the right photograph, Figure 9a.

Fig. 10a. Fig. 10a. Fig. 10b. Fig. 10b.

Figure 9b. To obtain material for the lower lip and chin including the mental part of the mandible, the flap outlined in Figure 9b, left photograph,which include the head and 3 inches of the full thickness of the clavicle, was raised up and sutured back in its bed-delayed transplantation. This was done under novocaine. A subsequent bronchitis precluded transferring this flap and several months elapsed before the flap was again raised up and again re-sutured in its bed, preparatory to transfer. This time the tip of the flap became gangrenous, as shown in the right photograph. Ten days later the skin covering the chin area and the lower lip were split vertically in the mid-line and a transverse incision was made on the chin surface below (right hand picture Figure 9c). The resulting flaps were dissected laterally, exposing the free ends of mandible on each side. That on the left was shorter than on the right but in twisting the pedicle to throw the skin surface forward the head of the clavicle was brought in contact with the end of the shorter left mandible which compensated for its shortness and allowed the graft to lie transversely. The chin and the right two-thirds of the lower lip, external and

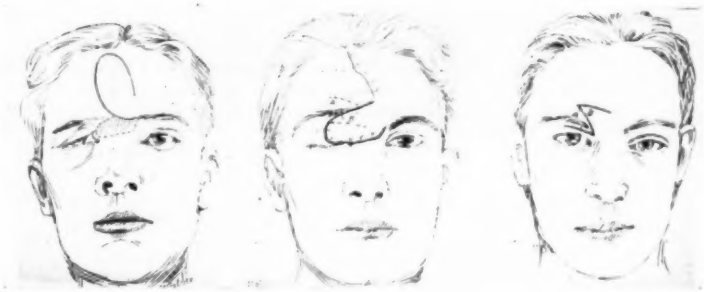

Fig. 11a.

Fig. 11b. Fig. 11b. Fig. 11c. Fig. 11c.

Fig. 12a.

internal surfaces, were reproduced in this way, and by suturing the intra-oral skin to the freed sublingual mucosa, the upper surface of the graft was entirely covered.

Figure 9c shows the manner in which the flap was transferred. Some time before the clavicle flap was placed in the chin, a little plastic operation was done on the lower lip to help prevent the dribbling of saliva, which in these cases is very annoying. The plan of this operation is shown in the two central sketches, Figure 9c.

Figure 9d shows the result of the placing of the chest-clavicle flap in the chin after the pedicle had been cut and returned to the neck. It looked like a big flap when it was made but if it had been twice as broad the result would have been very much better.

Figure 9e shows a front view of the condition on arrival at the reconstruction hospital and of the final condition after the point of the chin had been rounded out with a cartilage graft and making some adjustments of the lower lip.

Figure 9f. The right hand photograph shows side view of the case after the cartilage transplant was made. The distance from the columella to the tip of the chin is greater than the ordinary formulæ for good facial balance calls for but this helps to neutralize the very prominent nose. The full extent of the original deformity can not be appreciated from the left hand picture because it is not a true profile. Later, after the labio-alveolar fornix was reconstructed with a skin graft Captain Dameron fitted him with a denture.

Figure 9g is a roentgenogram of the clavicle graft in place, bony union having occurred and the wire not having been removed. Note that on the right side, the graft was a bit short and had only slight contact with the jaw bone, but a growth of bone has bridged the space. On the left side, because the remaining part of the body of the jaw was shorter than the right, the edge of the head of the clavicle was placed against the end of the body of the jaw so as to throw the graft as far forward as possible. Note that the prominent border of the head of the clavicle has been absorbed all around except where in contact with the jaw and here the contact has been strengthened by a deposit of bone. This is but another illustration of the truth and force of Lane's definition of bone; "ossification in the lines of force."

Figures 10a and 10b. An injury of which there were relatively few instances during the war was clipping out the root of the nose and, unfortunately, usually associated with the loss of one or both eyes.

Fig. 12b.

Fig. 12b.

Fig. 12c.

Fig. 12c.

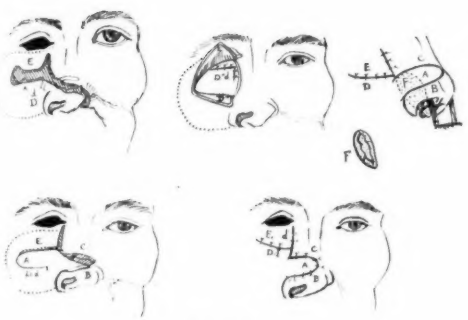

Fig. 13a.

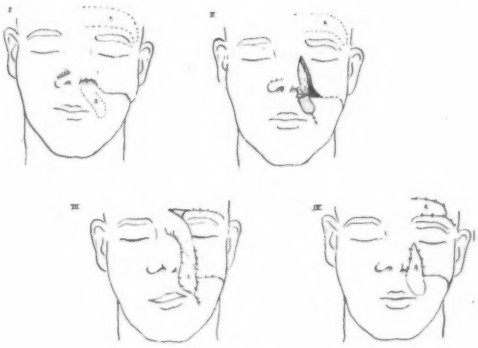

Fig. 13c.

Fig. 13b. Fig. 13b. Fig. 13d. Fig. 13g. Fig. 13g.

Fig. 13e.

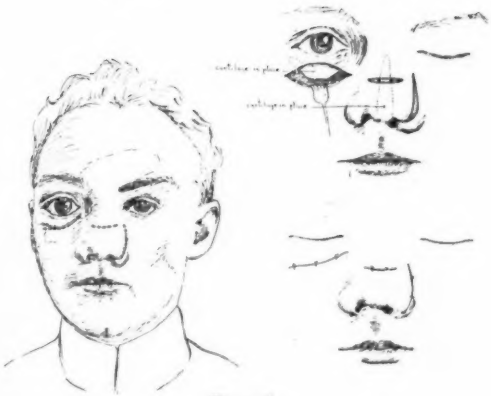

Fig. 13f.

In this case though both eyes are gone, the lids are undamaged. The correction consisted in first cutting out all scar which allowed the tissues to retract, reproducing the original defect, and then turning a flap from the forehead which was sutured in such a way as to restore the contour of the bridge.

Figure 10b shows the result of operation in this case. If the defect to be bridged was very large, an osteoplastic flap was made of the periosteum and a strip of bone covering the frontal sinus and this was turned down on a hinge of periosteum and muscle so that what was the outer surface of the upper end of the strip of bone comes to rest on the upper end of what remains of the bridge of the nose. In one case so treated, pus was found in the opened frontal sinus: permanent drainage was established and the operation continued. After the bridge of bone is in place the covering flap of skin is turned down to cover it. This flap may be made at the same time to repair an eyelid.

Figures 11a 11b, and 11c. Figure 11a shows a case in which the nasal injury is combined with an injury of the upper eyelid. The central figure

Fig. 13h. Fig. 13h. Fig. 13i. Fig. 13i.

shows the forehead flap turned into place and the forehead defect converted into a linear wound. In placing this flap, the inner end of the right eyelid was forced to an abnormally high position. The right hand figure shows subsequent correction of this by a "Z" incision and switching the flaps.

Figures 11b and 11c are profile and front views of the case illustrated in Figure 11a, showing the condition as he came to the rescontruction hospital, and also upon his discharge.

Figures 12a, 12b, and 12c. Figure 12a drawings of a case following an open fracture of the nose with considerable laceration of the soft parts. The bone bridge was depressed and displaced laterally. The upper left hand picture shows the lateral view, while that to the right is a front view with the flaps for correction outlined on the surface. The "A" flap included the full thickness of the nasal bones, and was raised from its bed with a chisel, and fractured across its base. The "B" flap was of the soft tissues only. After the "B" flap was raised the tip of the "A" flap was brought to the left so that it rested upon the lower boundary of the notch, while the "B" flap was switched to the right to take the place of the "A" flap, as shown in the lower right right hand figures.

Figures 12b and 12c show the case before the operation and the result of the operation. It also shows a downward displacement of the inner canthus only partially corrected at this time. The downward depression of the inner canthus in these cases where the scars go through the nasal and lachrymal bones consist in the removal of the lachrymal sac and cutting a tongue-shaped flap from the upper eyelid, base on the root of the nose, and switching it into an incision made transversely just below the canthus after the canthus has been moved up to its proper position.

Figures 13a, 13b, 13c, 13d, 13e, 13f, 13g, 13h, 13i, Figure 13a are drawings of the right side of a face that was very much damaged by shell. The damage to the nose is shown in this and in subsequent figures, but the depression and loss of bone below the right eye socket does not show. The shaded areas in the upper left figure represent the scar excision. The undermining beneath "E" was just beneath the skin while that under "A" and "D" was just superficial to the periosteum. After the flap "A" consisting of skin and superficial fascia was raised from its bed (lower left figure), the deep surface of the subjacent deep tissues was superimposed on the subcutaneous tissue under "E," as shown in the upper central figure thus partially filling the hollow below the socket, approximating "D" to "E" and raising the right corner of the mouth. Then the skin flaps "E" and "D" were sutured and the "A" flap placed between "C" and "B" as shown in the lower right figure. Later the flattened nasal bones were chiseled free from the nasal processes of the maxillæ, pried forward and held there by a dental splint, as shown in the upper right figure and in 13b. The left hand photograph shows the splint in place anchored to the teeth. The one to the right also shows the left ala to be entirely missing and a deep scar on the cheek. This splint was made by Capt. Dameron, D.C., U. S. A.

Figure 13c illustrates how the material for the left ala was obtained. The scar in the left cheek was excised. The flaps "A" and "B" were outlined, "B" was raised and sutured raw surface out, into the defect in the left side of the nose after the scar was removed. It was then covered by the "A" flap, as shown in lower left hand figure. Later the "A" pedicle was cut and the unused parts returned to the forehead. This produced the condition shown in Fig. 13d. The thickness of the ala was reduced by subcutaneous excisions and, by the operations shown in Fig. 13e, the crease between the ala and cheek was reproduced. It was further deepened by lining the depth of the excision with a (Thiersch) graft. The part of this deformity dependent upon the depression of the right lower lid was corrected by switching a flap from the temple into the cheek just below the lid and also by implanting a piece of costal cartilage into the defect in the lower border of the orbit. A piece of cartilage was also implanted into the nose, see Figures 13f and 13g, a stage in the progress of the case.

Fig. 14a-1. Fig. 14c. Fig. 14e. Fig. 14e.

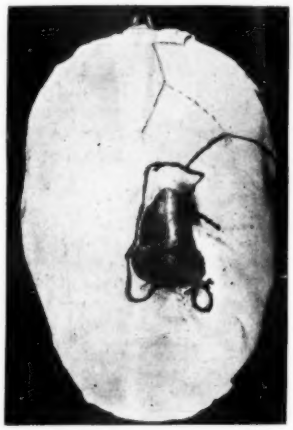

Fig. 14a-2.

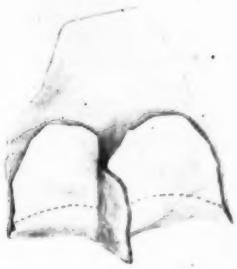

Fig. 14b.

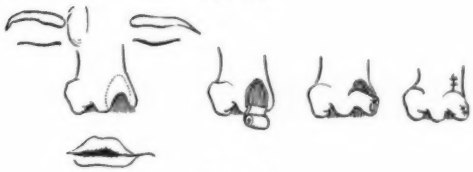

Fig. 14d.

Fig. 14f. Fig. 14f. Fig. 14g. Fig. 14g.

Figures 13h and 13i show the front and profile view as they were on entering the hospital and as they appeared near the completion of the case. The stare that remains about the right eye is due to poor action of the upper lid dependent on a badly fitting artificial eye. Note that the relation of the margin of the lower lid to the iris is about the same in each eye. The full extent of the original deformity cannot be gaged from Figure 13i, because it is not a true profile. The true profile position to the ordinary photographer of commerce is like the giraffe to the farmer. "There ain't no such animal." On the other hand Miss Hance has by the skillful use of lights entirely eliminated the cheek scar which though not depressed still shows on the man.

Figures 14a, 14b, 14c, 14d, 14e, 14f, and 14g. Figure 14a shows a soldier who had extensive destruction of the nose and left maxilla with a downward slump of the left lip, cheek, palpebral fissure, and eyeball. The cartilage on the forehead had previously been implanted for the purpose of making the nasal bridge. This cartilage was not used, however, and was later removed. The first steps of the final plan of reconstruction are shown in Figure 14a-2. On a plaster cast of the patient a clay nose has been modeled. From this clay nose a tinfoil pattern was made which later was used to outline the flap on the forehead and its plan of implantation laid out.

Figure 14b is a drawing of the tinfoil pattern of the flap folded in the manner it was used (you are supposed to be looking at the inner surface). The double fold in the center is the future columella and septum while the surfaces on either side of this represent the skin lining of the nostrils. The main part of the flap has its skin surface away from you and part of the raw surface is exposed. This uncovered area will be applied to the raw surface of the trap-door flap to be turned downward from between the eyebrows. The dotted line on the folded tinfoil pattern is to indicate the actual length of the future nose. The extra amount of the flap below this will be required to make the fold that will constitute the edge of the nostrils.

Figure 14c shows appearance when this flap was first turned down into place. Notice that on his left side an attempt was made to utilize a part of the original ala. This was a great mistake and necessitated the series of operations shown in Figure 14d, and the resulting irregularities have never been entirely smoothed out. It is often better to eliminate a distorted ala and make an entire new one.

Figure 14e. The photograph to the left shows an almost front view of patient as he came to the reconstruction hospital. The picture to the right shows result of implanting costal cartilage and shaping up the flap. Note that the left eye is still lower than the right. The slump of the left upper lip and depression of the eyeball and palpebral fissure have been partially corrected by plastics, skin graft, and cartilage implant, but this point is still being worked upon.

Figure 14f is a side view, from the left, of condition on entering reconstruction hospital and also at the present time. Note scars from operations on reconstructed ala.

Figure 14g. Corresponding views from the right. Note that the upper lip has been raised and given a better shape by turning in part of the original skin of the nose to extend the floor of the nares forward. Note also the columella and the new ala.

GRANULOMA INGUINALE[1]

By ALEXANDER RANDALL, F.A.C.S., JAMES C. SMALL, M.D.,
AND
WILLIAM P. BELK, M.D., PHILADELPHIA
From the wards and laboratories of the Philadelphia General Hospital

FOLLOWING the illustrated report in May, 1920, by Symmers and Frost (18) of the finding of two cases of granuloma inguinale in Bellevue Hospital, New York, we were inclined to feel that similar cases had been seen in this vicinity, especially in the wards of the Philadelphia General Hospital.

Beginning January 1, 1921, a search was instituted with the startling result that *five* men and *two* women were found at that time in the wards suffering from granuloma inguinale in its varying forms. Clinical studies and laboratory investigations were started at once, and we wish herein to report the results of these preliminary studies carried on during the past 7 months. Subsequent admissions have raised the total number of cases to sixteen.

INCIDENCE OF THE DISEASE

There is not the slightest doubt that this supposedly tropical disease has been endemic in the vicinity of Philadelphia for the past 50 years at least. In the accurate recollections of men, both physicians and ward attendants, who have been in charge of the genito-urinary services, the condition has been recognized, though wrongly diagnosed, for the past 25 years. We have been fortunate in acquiring some photographs, made for the late Orville Horwitz, showing similar lesions that he was familiar with during his long services in the hospital, though again masquerading under a mistaken diagnosis.

It is conservative to say that 15 or more patients are admitted to this hospital yearly suffering from this disease. They receive some treatment, gain some improvement, leave the institution; and it has been the experience of those in charge that the majority return because of a recurrence of the condition within the following 2 years. The varying manifestations of the disease do not always place them in the genito-urinary wards, and patients have been observed in the dermatological, surgical, gynecological, and obstetrical wards. That the condition is endemic elsewhere in the country is practically assured. Lippincott, of Camden, has furnished us with one of our cases and has seen others since its recognition. Ross, of Richmond, has a group of cases found in Robert Bryan's clinic. Geraghty, of Baltimore, reports that he has seen the condition repeatedly in the Hopkins clinic. Walker (19) reports a case seen in San Francisco, though an importation of the disease acquired in South America. Campbell has recently reported cases from Bellevue Hospital, New York, with the citation of cases reported from other parts of the country.

HISTORY

The most complete study of the condition exists in the work of Aragao and Vianna (2), of Rio Janerio, where the disease has been present constantly and recognized for a number of years. Rio Janerio is in a southern latitude corresponding to a point between Florida and Cuba in the northern hemisphere. Within these geographical limits the condition has been met with repeatedly and hence the erroneous assumption that it is a tropical disease has prevailed. Its peculiar predilection for the negro has possibly made this assumption seem more of a fact.

The literature contains numerous scattered observations relative to the clinical aspects of small groups of cases of granuloma inguinale or the use of tartar emetic intravenously in its treatment. Cummings (7) treated a patient with antimony and potassium tartrate intramuscularly. Hoffman (10) has published a recent clinical study from Germany treating his observed cases intra-

[1] Received for publication in October, 1921.

venously. Reed and Wolf (15) have encountered the disease in New Orleans and have successfully treated it with antimony intravenously. Cuthbert (8) reports a case from England similarly treated. Aragao (1) in a recent article brings his bacteriological studies up to date, claiming that though the organism originally described by Donovan is easily found in smears and is pathognomic, yet it has never been cultivated. Campbell (4) reports three further patients observed in Bellevue Hospital.

The use of antimony and potassium tartrate (tartar emetic) as an intravenous medicament, has been gaining ground rapidly. Aragao and Vianna, in 1912, were the first to point out its value and almost specific action in granuloma inguinale. Recent literature contains numerous references to its use and beneficial action in bilharziasis (17, 11, 14), filariasis (12), gangosa (6), cachar sore (16), malaria (3), leishmaniasis (5) and trypanosomiasis (5). The future seems brilliant for this erstwhile popular and almost discarded drug with the possibility of other synthetic compounds.

Our first presentation of patients was on January 24, 1921, before the Philadelphia Urological Society, with subsequent public expositions of the progress of the work as follows: Philadelphia Urological Society, March 28, 1921; American Association of Genito-Urinary Surgeons (Richmond, Virginia) May 3, 1921, and the Philadelphia Pathological Society, May 26, 1921. We likewise published a preliminary report in the *Journal of Urology* June, 1921.

CHARACTER OF LESIONS

The usual history is that the lesion started as a small papule, non-inflamatory, which after rupture and the exudation of slightly purulent fluid, refused to heal, and exhibited progressive tendencies toward slow proliferation and spreading. The typical lesion (especially seen when involving the inguinal region), is a flesh-red, exuberant, overgrowth of soft granulation tissue. A wire loop for making cultures can be pushed into this soft tissue to the depth of several millimeters. It has absolutely no similarity to an ulcer, with its eroding, undermining edges, and necrotic base. The center of the granuloma appears slightly depressed, and there is certainly a destructive action present, but the edges are redundant and overlap the apparently healthy skin margin to the height of 6 to 8 millimeters. Exudate is scant, mucoid in character, of a non-offensive odor, and when wiped with gauze is easily removed, leaving a clean, red, bleeding surface, similar in every respect to a large area of healthy granulation tissue as seen in clean surgical wounds. This picture varies according to the duration size, and location. The older lesions show at times tendencies toward cicatrization at some points, while spreading in others, but this occurs only when flat, non-chafing surfaces are involved. Large lesions, especially those of the perineum, become bulbous, simulating condylomata acuminata, with large rounded heads of new-growth, the heads ofttimes with pearly white surfaces of epithelization, and deep crypts with raw granulomatous surfaces. Secondary infection here causes the clean, odorless character to change.

As indicated by the name, the most frequent location is in the groin spreading upward as far as the anterior superior spine and downward through the fold of the groin, frequently involving the perineum, and in some cases following the fold of the nates and spreading to the buttocks. Prepucial lesions are likewise frequently associated and at times primary, and involvement here has given us the most destructive picture with a gradual erosion of the glans and even the shaft of the penis. In the male we have had 4 cases where the lesion was limited to the groin alone: 2 cases of penile involvement; 1 limited to the anal region alone; and the remainder with multiple involvement including the perineum.

In the female the labia majora suffer most, though groin lesions are again characteristic; and once the external genitalia become involved, the entire vulvoperineal region suffers and the spread is the same as in the male. We have observed extension in two cases into the vagina and rectum. The labia swell enormously and become almost elephantine.

In certain patients the history apparently points to a granuloma infection superimposed upon a prior existent genital lesion.

SYMPTOMS

The patient has few subjective symptoms. They suffer no pain or discomfort unless the involved areas are so placed as to cause chafing. The granuloma is practically painless to the touch, and only deep pinching up of the mass will cause suffering. Practically all of our patients have shown a marked degree of secondary anæmia, but there has been a complete absence of pyrexia, chill, leucocytosis, throbbing, lassitude, or the usual concomitants of infectious processes. Their blood counts show a decrease in red cells commeasurate to their anæmia. No leucocytosis, eosinophilia or other characteristic change has been observed in the white blood cells. Fragility tests and blood-platelet counts are likewise normal.

Wassermann tests have been negative with a few exceptions where undoubtedly a double infection has been present, and in these energetic antiluetic treatment has been devoid of effect upon the granuloma, and no other evidence of lues has been present (where the Wassermann test was positive) except a history of prior infection.

RACE

All of our cases, with one exception, have occurred in the negro. The one exception is that of a white male, in whom the lesion has likewise been atypical, simulating a phagodenic chancroidal sore with ragged ulcerated edges. His bacteriological examination was positive and he may be harboring a double infection. He, however, has responded to treatment slowly, and healing has progressed under specific treatment with antimony, after being entirely rebellious to arsenic and all local applications, though it must be recorded that complete and permanent cure has not been obtained in his case to date.

DIAGNOSIS

We have based our diagnosis on the fairly characteristic clinical pictures, and also especially on the bacteriological findings of the specific organism. This latter is done by making smears from the exuding surface, in which will be found numerous large mononuclear plasma cells the protoplasm of which, on proper staining, will be found studded with the characteristic encapsulated bacillus originally described by Donovan. The therapeutic result from the use of antimony intravenously may likewise be taken as indicative of the accuracy of the diagnosis, for, after three or four administrations, the organism disappears entirely from the surface and cannot be found in the smears, and healing promptly follows.

That the condition has been constantly present in the hospital wards of this vicinity carries with it the necessity that it has masqueraded under other and faulty diagnoses. Many have been considered chancroidal sores to which it bears no relation (except where secondarily infected as in the perineal lesions), for the ulcerated, undermined edges and the foul purulent discharge are absent. Tertiary syphilis with its varying manifestations has claimed others, especially before the days of the Wassermann test and arsenic therapy. Condylomata acuminata, especially when seen in the female, may have been confusing, while condylomata lata bear close resemblance to the lesion of granuloma when the latter occur about the anus (see Case 6).

In our genito-urinary wards, the diagnosis has been for the past two decades tuberculosis cutis, and this I find was what the late Orville Horwitz considered it. A. A. Uhle, shortly before his death, was interested in the etiology of these cases, and in conjunction with Randle Rosenberger undertook some investigations in an attempt to establish the tuberculous nature of the lesion but, failing to demonstrate to their satisfaction that this infection was present, carried the work no further. Its similarity to lupus and the improvement under X-ray therapy was always held as the sole argument in favor of this diagnosis.

Any pudendal sore, resistant to the ordinary surgical antiseptics, unimproved by arsenical therapy, of long duration, and especially when devoid of pain, should be searched

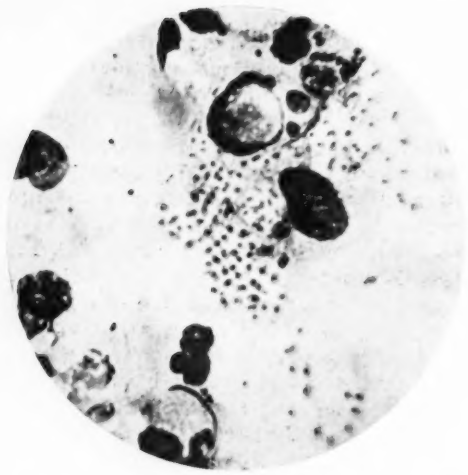

Fig. 1. Smear from lesion. Wright's stain. x, 800. Donovan's organisms in and about mononuclear cells. A rounded "nest" of non-encapsulated organisms appears in the disintegrating cytoplasm of one of the cells.

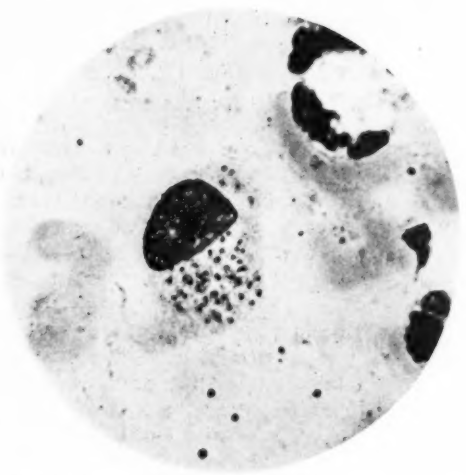

Fig. 2. Smear from lesion; Wright's stain. x, 1200. Intact mononuclear cell showing cytoplasm studded with Donovan's organisms—capsules narrow or absent.

for the specific organism of granuloma inguinale and given the advantage of antimonial treatment.

BACTERIOLOGICAL METHODS AND DIAGNOSIS

Direct smears from the lesions, properly prepared and stained, constitute a very reliable method of diagnosis. The material is best collected by means of a stiff inoculating wire loop which can be inserted quite deeply into the friable granulations of the lesions, rotated gently and withdrawn quickly in order to bring an inoculum from the deeper parts. Surface contamination can be minimized by first sponging off any surface exudate with sterile gauze. Suitable material for diagnostic smears may be obtained also on small cotton swabs from such a cleansed surface of the lesion, but where cultures are to be attempted material from the deeper parts of the lesion is to be desired. Thin spreads of this material are essential. These are dried quickly in air and stained either by the Wright's or the Giemsa method. Wright's staining is the more rapid and has given satisfactory results. The proper differentiation of the stained smear in distilled water is the chief technical difficulty. Even with the most intense staining this differentiation should not be carried out for more than 15 or 20 seconds. Overdifferentiation completely decolorizes the capsules of the organisms; while underdifferentiation fails to bring out detail and contrast between the body proper and the capsule.

The best staining results show the organisms as small, rounded, pink bodies with a dark blue coccoid body in the center; or, more frequently as oval pink bodies with a blue bacillary or diplococcoid body occupying the longitudinal axis. The pink outer zone is a wide capsule. The dark blue central bodies represent metachromatic granules within the body proper. The true outline of the body proper can be studied only after the capsule has been entirely decolorized.

In stained preparations from the lesions, some areas will show organisms with the capsules stained a pale blue and with obscurely differentiated central bodies; other areas will show well-defined dark blue metachromatic granules surrounded by a pink capsule; and still other areas where the capsules have been entirely destained and in which the organisms appear as short, thick bacilli with blunt, rounded ends occupied by the dark blue metachromatic granules, presenting a true bipolar stained appearance with the intervening body shaft stained a pale

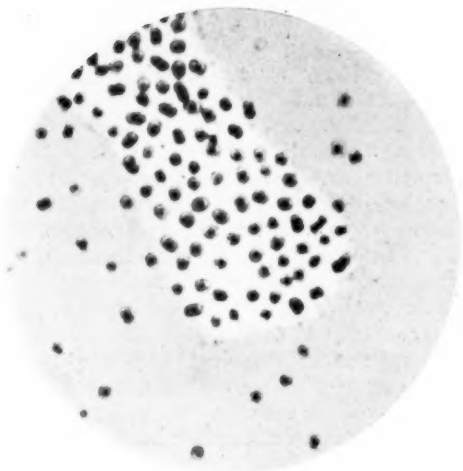

Fig. 3. Preparation from acid dextrose agar culture; Wright's stain. x, 1200. Capsules stained, typical morphology.

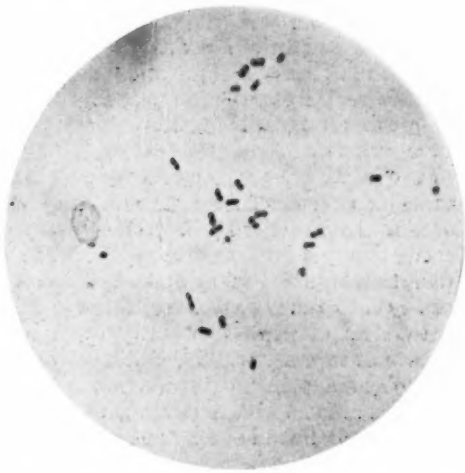

Fig. 4. Young broth culture; Wright's stain. x, 800. Bipolar staining and solid staining of organisms. No capsules.

blue. Always a few organisms, usually shorter than those just described, are seen to stain solidly a deep blue.

The organisms are found within the cytoplasm of large mononuclear cells. In such they either have well-defined capsules, or appear in nests occupying a rounded area within the cell and revealing no capsules. Within these nests the bipolar staining may at times be observed. The polymorphonuclear leucocytes do not contain encapsulated forms. Encapsulated organisms may appear free, or in relation to cellular detritus, chiefly in groups and in the neighborhood of large naked nuclei of disintegrating mononuclear cells.

Smears from the lesions are remarkably sparse in other bacteria as compared with smear preparations from the other types of ulcerative lesions about the genitalia. Staphylococci, streptococci, diphtheroid bacilli, and bacilli of the morphology and staining characters of the colon group may be observed widely scattered, or grouped within the polymorphonuclear leucocytes.

Cultures from the lesions. Material collected from the lesions has been inoculated on various types of media and grown under different conditions. In the cases of three patients an organism has been obtained, which, in stained preparations from the cultures, resembles the organisms seen in the mononuclear cells in stained preparations of the exudate directly from the lesions. Failure to obtain this organism in cultures from all the lesions as well as subsequent failure to produce chronic lesions in animals by inoculation of the organisms, has led us to study carefully the different bacteria growing in cultures from the lesions. The general plan of this study will be mentioned later.

Aragao and Vianna (2) called attention to an organism grown in three of seven granuloma lesions studied, and described it under the name of calymmatobacterium granulomatis. Their description of this organism places it within the group of gram-negative encapsulated bacilli and does not differentiate it from the bacillus mucosus capsulatus group sufficiently to warrant its separate classification and new nomenclature. They presented this organism as the specific causative agent of granuloma inguinale on rather incomplete evidence. Since then one of them (Aragao, 1) has reported further studies with the conclusion that the organism described by them in cultures is not the causative agent of the disease, stating further that the specific organism has not been cultured. Walker (19)

in one case isolated a gram-negative, encapsulated bacillus. He was unable to produce chronic granulomatous lesions in animals, nor in several instances in men. Lynch (13) has grown an organism in his cases but does not describe it.

In our study, plate cultures have been made on acid dextrose agar (Ph. 6.6) and infusion blood agar (Ph. 7.4) by surface inoculation and incubated at 37° C. Material from the lesions has also been inoculated heavily into tubes containing about 5 cubic centimeters of peptone water. From such tubes after several hours' incubation at 37° C., anaerobic and partial oxygen tension cultures have been made. Plate cultures on Sabourauds medium have been carried at 20° C. for long incubation periods and studied for molds and yeasts.

In all cultures search was made first for organisms which, when stained with Wright's stain, might present any of the distinctive staining and morphologic characters of the organisms uniformly found in the direct smear preparations from the lesions. This required the isolation of organisms in pure culture and growth in many subcultures in order that the morphology and staining properties might be observed for the growths of the particular organism on various kinds of media. Where an organism of the encapsulated, gram-negative bacillus group was isolated, the strain was preserved to be subjected to detailed bacteriological study. The finding of such a strain did not modify the more tedious study of the morphology and staining properties of the other organisms appearing in the primary cultures from any particular patient. The protean-staining results with a Romanowsky stain are soon very well appreciated when it is employed in such a study of bacteria. Repeated stained preparations of an organism are frequently necessary in order to exclude these aberrant results which may present appearances suggestive of the metachromatic staining constantly observed in the Donovan organisms of the direct smears from granuloma lesions. The organisms found to present these staining characters, with any degree of consistency, were next subjected to tests planned to demonstrate the effect of tartar emetic upon their growth in suitable media in the test tube. If any appreciable inhibitory effect was noted, animals were inoculated intraperitoneally, cutaneously, and subcutaneously. The general plan of this animal experimental work was first to inoculate large doses of the culture intraperitoneally into white mice. At 2, 4, and 6 hours after inoculation, stained preparations of the peritoneal exudate were made to determine, first, the character of the cellular reaction (whether mononuclear or polymorphonuclear); second, the type of cell phagocytosing the bacteria injected; third, to study the morphology and staining of the bacteria as they occurred free in the exudate or included in the cells; and fourth, to gain some idea of the pathogenicity of the organism for white mice. In some instances guinea pigs were used also in the same manner as the mice.

Animals inoculated cutaneously and subcutaneously were observed over long periods for the development of lesions, which latter appearing were studied from time to time by means of stained smears and by cultures.

By employing the above methods in the cases of 12 patients, in all of whom the Donovan organisms were found in the direct smears from the lesions, we have obtained an organism in culture closely resembling these bodies in three instances. These organisms have proved to be encapsulated bacilli of the bacillus mucosus capsulatus group, and very probably correspond to the organisms reported by other workers in cultures from similar lesions. They grow freely on all the ordinary culture media and their growth is favored by an acid reaction. The acidity of the media may be increased to a point where the growth of the ordinary contaminating bacteria is markedly inhibited before any appreciable inhibition of the growth of this organism is observed. This is especially true if a simple carbohydrate is added to the media.

The surface growth of these organisms is quite characteristically that of the Friedlaender bacillus. The colonies appear as slightly gray-white, translucent, glistening, dome-shaped elevations on round regular bases from 1 to 3 millimeters in diameter.

When touched with an inoculating wire they appear quite viscid, having the appearance and consistency of thin starch paste. By transmitted light they are translucent and have a slightly brownish tinge. They are usually the largest colonies appearing in the mixed primary cultures and are very readily recognized. In subcultures the growth is profuse on all the simpler laboratory media and the growth on agar, gelatin, or coagulated blood serum does not differ essentially from that described above. In fluid media diffuse turbidity develops with a surface ring of growth tending to adhere to the sides of the tube and to climb slightly above the level of the liquid. Later sedimentation occurs. Growth is profuse even in 1 per cent peptone water. In litmus milk, there is acid formation and coagulation within 24 hours. On potato growth is abundant, moist and brown, with decided blackening of the potato.

In stained smears preferably from the acid glucose agar cultures, wide capsules are easily demonstrated, so that the organisms appear as do the Donovan organisms in the exudate from the lesions. In the stained smears from broth cultures, the capsules are not demonstrated, the organisms appearing as short, plump bacilli, exhibiting irregular staining, for the most part showing a dark area at either pole, with a pale, intervening area. In old cultures, especially in a medium containing a carbohydrate which has fermented with decided acid production, long forms are found. These forms also stain irregularly, presenting dark blue, banded areas, alternating with pale areas throughout the length of the organism.

The organism is a gram negative, nonmotile, non-sporulent, encapsulated bacillus, which shows metachromatic granules as well as capsules with Romanowsky staining. It does not liquefy gelatin or coagulate serum. Freshly isolated cultures hæmolize blood. Milk is coagulated and acidified. Indol is not produced. The organism ferments dextrose, levulose, lactose, galactose, saccharose, maltose, mannit, arabinose, salicin, inulin, and dextrin. It does not ferment dulcit nor rice starch.

Repeated cultures have failed to yield this organism in the other patients, so that a thorough search of the bacteria growing in all the primary cultures was conducted to determine whether among the colonies growing there might be organisms showing other gross cultural characters, but which might upon proper staining show some of the characteristics of the Donovan bodies. Many strains of different bacteria have been isolated because of some suggestive staining property with the Wright's stain and a number of these have been carried through to animal inoculation for the purpose of studying the appearance of the particular organism in the animal exudates. In no instance was found an organism which tended to occur in the mononuclear cells, although in many such exudates when examined within 6 hours after inoculation there appeared considerable numbers of mononuclear cells. The morphology of Donovan organisms was not approximated by any of the organisms examined in these exudates, except by the three strains of encapsulated bacilli as mentioned above.

Animal inoculations. The three strains of encapsulated bacilli isolated from granuloma lesions have been studied in detail by experiments in which six strains of the bacillus mucosus capsulatus group (Friedlaender's) isolated from the throats, sputum, and empyema fluid of patients in this hospital have been carried in parallel experiments. These experiments will be reported in a subsequent paper; we simply say at this time that these studies have failed to show any distinctive properties which might serve to differentiate the strains of granuloma origin from those of respiratory origin. Lesions produced in experimental animals with strains of granuloma origin may just as easily be produced with strains of respiratory origin and in our experience the lesions appear identical.

Experiments with strains of granuloma origin. Intraperitoneal inoculations of mice and guinea pigs have proved rapidly fatal. The exudate when examined early, 2, 4, and 6 hours after inoculation, shows a mononuclear cell reaction; later the polymorphonuclear cells predominate. The bacteria occur for the most part free in the fluid and present wide capsules. They resemble the Donovan bodies with well-developed capsules. Some

when superimposed on the mononuclear cells are very characteristic, but the rounded nests of bacteria, showing only narrow capsules or no capsules, lying unmistakenly within the mononuclear cell cytoplasm, have in no instances been observed.

Cutaneous inoculations of mice, guinea pigs, rabbits, cats, and dogs have invariably failed to produce lesions. Abraded skin areas over the arm of an adult colored male (Case 12) were inoculated, (a) with granuloma strain I; (b) with granuloma strain II; (c) with a strain of Friedlaender's bacillus of mouth origin; and (d) with sterile normal salt solution. These were observed for a period of 19 days before the treatment with tartar emetic was started. All crusted over and healed promptly.[1]

Subcutaneous inoculations of guinea pigs, cats, and dogs have failed to produce lesions. Subcutaneous inoculations of mice have at times resulted in the death of the animal from a generalized infection; at other times in abscess formation which healed promptly either with or without breaking down with ulcer formation.

Subcutaneous inoculations of rabbits with 1 cubic centimeter of broth culture of the organisms have produced focal lesions. Beginning as firm, indurated masses, they appeared after 7 to 10 days as large doughy abscesses. These might point in one or more places, breaking down to form well-defined ulcers in the depths of which appeared the tough, cheesy, necrotic material which we have come to regard as the typical contents of abscesses produced experimentally in rabbits by the Friedlaender bacillus. These abscesses drained imperfectly through the spontaneous openings. Firm pressure on the abscess adjacent to the ulcer expressed the necrotic material and tended to produce some bleeding from the margin as well as from the depths of the ulcer. Evacuation of this material hastened healing. Left to themselves these lesions would heal slowly, the necrotic material being in part thrown off and in part absorbed. The lesions always healed spontaneously in from 3 to 7 weeks after inoculation. In the necrotic material and from the granulations bordering the ulcer, the encapsulated bacilli could be demonstrated by smear and culture. In the smear preparations from the granulating border, the nests of bacteria within mononuclear cells could not be demonstrated. In some cases the typical doughy abscess would not rupture, healing taking place after absorption of the necrotic material.

In mice and rabbits, some experiments were planned with the view of attempting to establish symbolic relations in an experimental lesion between the encapsulated bacilli of granuloma origin and some of the other types of bacteria isolated from granuloma lesions. Bacteria of the staphylococcus, colon, and diphtheroid group were used, being injected simultaneously with the inoculum of the encapsulated bacillus. The lesions produced by the encapsulated bacilli following subcutaneous injection were not modified by this method of inoculation, except in rabbits when injected with staphylococcus aureus, with which abscess formed more promptly and always ruptured spontaneously. The rate of healing did not appear to be affected.

HISTOPATHOLOGY

Stained sections of granuloma inguinale show a superficial cellular area surmounted on a base of dense, hyaline, connective tissue. The transition is rather sudden, but no distinct line of demarcation separates the two elements. The cellular area is composed of a young connective tissue, relatively small in amount, many endothelial leucocytes, and a smaller number of polymorphonuclear neutrophiles. The proportion of the latter varies considerably, appearing most numerous in untreated cases. They are probably an index of secondary infection. Many lymphocytes are also present, and an occasional eosinophile. Blood-vessel formation is present as in any active granulation tissue. At the margin of the granulation, the squamous epithelium of the skin is seen partially destroyed and replaced. Further out this merges into normal skin, under which, however, the subcutaneous tissues are infiltrated for a little distance by round cells. This would indicate that the lesions extend somewhat farther than would appear on superficial inspection of the granulating area.

[1] Recently, in 2 patients, similar inoculations have yielded negative results.

A feature worthy of note is the proliferation of squamous epithelium near the edges of the granuloma, where finger-like projections extend for some distance into the deeper tissues. In some cases this suggested a squamous-cell carcinoma.

After treatment for some time with antimony injections, the dense fibrous tissue is seen to have replaced the granulations to a large extent. Small collections of lymphocytes remain in this fibrous growth, and a smaller number of endothelial cells. Polymorphonuclear cells have entirely disappeared. A bipolar bacillus, without capsule, has been stained (by Giemsa's stain) in tissues, and these have been found only in the large mononuclear cells. The encapsulated organisms described have not been stained in tissues in this laboratory. However, smears made from the tissues immediately prior to fixation, or at the bedside during biopsy, and stained with Wright's stain, showed them in many cases.

Individual pathological studies appear with their case histories. Sections from one of the experimental animals (Rabbit 3) gave the following: Pieces of tissue from the subcutaneous mass in abdominal wall were fixed in 4 per cent formalin in normal sodium chloride and in Schaudin's fixative. The first were stained with hæmatoxylin and eosin, the last with Giemsa's stain. On examination, the following features were noted: a sparse growth of young connective tissue supported a very cellular mass, the cells were endothelioid and polymorphonuclear neutrophiles in about equal numbers; many small lymphocytes and an occasional eosinophile. New blood vessels were rather numerous, and considerable blood was present. Many small areas of necrosis were scattered throughout. In sections stained with Giemsa's stain a few coccoid bodies without capsules were seen in some mononuclear cells, but not in other phagocytes. The picture was strikingly similar to that of untreated granuloma lesions in man, except for the necrotic areas.

PROGNOSIS

As pointed out by all previous writers and substantiated by the histories of cases in the Philadelphia General Hospital in years gone by, the treatment of these lesions has been most disappointing until the present when antimony therapy was first instituted.

Local applications of salves, escharotics, and antiseptics do no good whatsoever; vaccine therapy has failed consistently; excision is followed almost uniformly by recurrence before healing; arsenic is of no benefit; and X-ray alone has been somewhat beneficial, causing a slow cicatrization, but because of the dangers associated with its use, it has been possible to apply it only once every 3 weeks, and therefore requiring on an average from 12 to 18 months to establish healing. Even with X-ray the hospital experience in the years past has been disappointing and probably at least 50 per cent of the cases returned with recurrences.

Some of our present cases have had two or more admissions in passing years for return of their lesions after apparent complete healing under X-ray therapy, while several have been inmates of the institution for so long that they have been put on the hospital's pay-roll and work as laborers about the buildings. That the condition has been in the experience of this hospital the actual cause of the death of the individual can be recalled by some of the older ward attendants, though not experienced in recent years since X-ray therapy has been used. Our personal experience is limited to the amount of destruction seen in Case 16, where the disease is known to have existed 10 years, causing a complete erosion of the penis.

With the proper application of the new antimony therapy the prognosis becomes extremely good, for the brilliant results seen and herein recorded place this drug as one of the small group of actual specific remedial agents and rapid and apparently complete cures can now be expected.

RESULTS

Of our 16 cases, we have accomplished a rapid and apparently complete cure in 15. The one exception is the case of a white male, before mentioned, whose lesion was not typical, whose organisms were not entirely characteristic, but who was given the advantage of the treatment when all other administrations had failed over a period of 7 months.

He has shown definite improvement (nowhere near as rapid as the true cases), but not yet complete healing (Case 14). We have had two recurrences (Cases 6 and 9), both due to early neglect of treatment and both rapidly healed on re-administration of tartar emetic. We have not seen in a single case any alarming symptoms from the use of the drug, and though the abbreviated case reports do not allow of the exposition of the complete case study, suffice it to say, that no blood or urine changes have been noted as evidence of its toxic effect or to contra-indicate its extensive use as a therapeutic agent. The brilliant recoveries that these patients have made from conditions of years' duration and manifold other forms of therapy, have been as inspiring to their attending physicians as they have been satisfactory to the patients themselves, who have appreciated more than any one else their first permanent relief from an apparently incurable condition. Several (Cases 2, 4, and 5) who were markedly anæmic and emaciated, have shown a general systematic inprovement with increase in hæmoglobin and decided increase in body weight.

TREATMENT

Following Vianna's work, we started giving antimony intravenously in the form of tartar emetic. The initial dose of 0.04 gram was used, and this quickly advanced to a maximum dosage of 0.10 gram. Our first treatments were given daily and most patients tolerated this until about ten doses had been given, but nearly all after that amount showed some symptoms of intolerance for the drug. We then began intermitting the daily dosage, governing the time by symptomatic data. This intolerance consisted of rheumatoid pains in the joints associated with stiffness, especially seen in the early morning on rising, most frequently located through the shoulder girdle, and as a rule wearing off during the course of the day. There have not been in any case symptoms of an alarming character.

The drug has been prepared by dissolving 0.1 gram in 10 cubic centimeters of sterile normal saline solution and is best preserved in sealed sterile ampules. Intravenous administration is essential.

The typical encapsulated organisms cannot be demonstrated in smears from the lesion after the second or third dose of the tartar emetic. Healing commences within 48 hours after the first administration, and from then on almost daily progress can be appreciated. Epithelial proliferation starts at the edges and rapidly spreads inward, while often isolated islets of epithelium in the midst of the granuloma, before not seen, or buried, start proliferation in the midst of the lesion and hurry the complete healing.

The phenomena of healing can best be pictured by comparing it to the use of salvarsan in somewhat similar long standing and untreated luetic skin lesions.

In some cases the administration of the drug causes a tingling, pricking sensation in the granuloma, immediately after the injection and ofttimes an excess of mucoid secretion occurs for the first few days. Scabbing over of the surface takes place whenever the raw surfaces are in apposition, and thin crusts form around the periphery of open areas.

The amount of drug administration necessary to complete a cure appears to be commeasurate with the extent of the lesion and the amount of epithelization necessary. Penile and groin lesions heal rapidly, while vulval and perineal, apparently on account of the apposition of surfaces, respond more slowly and show a tendency to dry and scab over first thus causing slower healing.

Through the courtesy of Professor John J. Abel, of the pharmacological department, Johns Hopkins Medical School, we had placed in our hands two synthetic antimony compounds for trial. One of these (sodium antimony thioglycollate), it will be noted, was used in Case 12, with brilliant results, and a further report will be made later.

Our simplest case required but four doses for complete epithelization of an area the size of a silver quarter: this patient then neglected treatment and had a recurrence 6 weeks later. The highest dosage for healing was in one of the females who had 1.96 grams of the drug in 32 injections. Following the advice of Vianna, we have advised all our patients to persist in taking weekly injections after com-

plete healing for at least 12 doses and in none adhering to this procedure have we observed a recurrence.

We wish, in closing to express our gratitude to three of the resident staff of the Philadelphia General Hospital; Drs. R. Bradley, P. P. Bailey and P. E. Lueke, for their personal interest and keen attention, which combined with technical ability of high degree in handling the intravenous medication made these results possible.

CONCLUSIONS

1. Granuloma inguinale, long considered a tropical disease, is endemic in the temperate zone of the United States.

2. Its diagnosis is dependent on (1) the characteristic local lesion, (2) the marked predominance in the negro race, (3) and the finding of the specific organism originally described by Donovan.

3. These organisms we have demonstrated in smears from granuloma lesions in 12 patients in our series of 16. In the other 4 instances laboratory examinations were not made.

4. An encapsulated bacillus, which when stained from cultures, resembles this organism, has been isolated from 3 of the 12 patients studied culturally. This bacillus is a member of the bacillus mucous capsulatus group.

5. The question remains as to whether the organism seen in smears and that obtained in cultures, which appear so similar, are identical.

6. Abscesses with spontaneous rupture and ulcer formation have been produced in rabbits by subcutaneous inoculation. These heal spontaneously in from 3 to 7 weeks and grossly cannot be regarded as granulomata although the walls of these abscesses on histological examination present granulation tissue not to be differentiated from that of the granuloma lesions. Friedlaender's bacillus forms similar lesions.

7. A few experiments attempting to establish symbiotic relationships between the encapsulated bacilli from granuloma lesions and staphylococci, colon bacilli, and diphtheroids in experimental lesions have failed. More work of this nature should be undertaken.

8. Treatment with tartar emetic intravenously acts as a specific, and rapid healing may be expected with the prompt disappearance of the specific organism.

9. We have experienced no contra-indication to the intravenous use of this drug up to doses as high as 0.1 gram.

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CASE REPORTS[1]

CASE 1. H. Q., male, negro, age 39, admitted January 3, 1921, complaining of ulceration of left groin, foreskin, and perineum. Patient born in the county bordering Philadelphia, and has spent all of his life hereabouts. He has never been out of the United States, never south of Baltimore nor north of New York City. He had gonorrhœa last spring, preceding the present trouble by 4 or 5 weeks. The condition began about 8 months ago as a small pimple in the left groin; it was only the size of a pin's head and not at all painful. It rapidly grew to the size of a quarter of a dollar, then broke down, discharging a purulent content, and has remained an open lesion ever since. Soon after the appearance of the lesion in the groin, and before the pimple in the groin broke down a similar one developed on the foreskin. This likewise became an open sore and the two have continually increased in size to the present condition. Examination reveals an area two finger breadths broad, extending from the inferior iliac spine down through the inguinal fold onto the perineum, and is the seat of a raw, flesh-red, soft, and oozing granulomatous mass. It is not depressed and ulcerated, but actually raised above the level of the surrounding skin. Similar lesions occur on the left side of the scrotum and encircling the margin of the foreskin preventing its retraction. The

[1]First three case reports in semi-detail to show typical histories, types of reaction, mode of administration and promptness of healing. Remaining histories extensively abbreviated on account of space.

center of the large groin sore is depressed, though uniformly covered with the soft, papillomatous proliferations. There is no offensive discharge, but a sanguinous exudate: no pain, except on deep pinching: and no enlargement of the underlying lymph glands.

Laboratory notes. January 25, 1921. Smears, Gram stain, staphylococci, diplococci and diphtheroids. Fontana's stain, few loosely coiled spirochætæ. Geimsa's stain, red blood cells, polymorphonuclears and large mononuclear cells, no granuloma bodies. Cultures, staphylococci, bacillus coli, and diphtheroids. February 1, 1921, smears (Wright's stain) positive for granuloma bodies. Culture on Sabouraud's medium, no growth after 72 hours. February 12, 1921, blood count, hæmoglobin, 45 per cent, red blood cells 1,000,000; white blood cells, 10,700; polymorphonuclear, 60 per cent; lymphocytes, 36 per cent; mononuclears, 2 per cent; eosinophiles, 2 per cent. February 19, 1921, blood count, hæmoglobin, 59 per cent, red blood cells, 3,380,000; white blood cells, 10,150; polymorphonuclear, 55 per cent; lymphocytes, 44 per cent; eosinophiles, 1 per cent. March 28, 1921, fragility test, complete hæmolysis, 0.20. Complete inhibition, 0.44. March 31, 1921, blood platelet count, 460,000. Reticulated reds, 0.52 per cent. April 4, 1921, smears (Wright's) no granuloma bodies. (Treatment started February 11, 1921.) Staphylococci, diphtheroids. Cultures—staphylococci, diphtheroids. NOTE—Cultures at no time from this patient were positive for the Friedlaender-like bacillus.

Histopathology. Section taken from margin of lesion. Fixed in 4 per cent formalin in normal saline and in Schaudin's solution. Stained with hæmatoxylin and eosin, and Giemsa. Showed typical picture as described above. Smear made at bedside, stained by Giemsa, showed encapsulated diplococci forms, intra- and extracellular. Section from prepuce, obtained at circumcision on May 9, 1921, after tartar emetic treatment, shows a small ulcer, pinhead size. Stained as above. Marked fibrosis; minute area containing many lymphocytes, a few endothelial cells, occasional polymorphonuclear cells. The squamous epithelium of the skin appeared practically normal.

Treatment. February 11, 1921, 0.05 gram tartar emetic given intravenously. Fifteen minutes after the injection, patient had a slight chill followed by headache. Urine analysis of today negative throughout. February 12, 1921, 0.05 gram tartar emetic given intravenously. Slept well last night and experienced nothing further than above mentioned chill. Today normal. February 13, 1921, surface of granuloma not so moist as formally, and of a lighter hue with less bleeding. Edges seem somewhat retracted and flattened. No local sensation experienced with the injections. Given 0.05 gram intravenously. February 15, 1921, wound and patient not disturbed yesterday. Dressing today is quite moist with a serous discharge. Edges show marked retraction, and epithelium is apparently spreading inward. Granulations less exuberant. 0.05 gram tartar emetic intravenously. No reaction. February 17, 1921, there is without doubt a decrease in the amount of serum which exudes from the granulations during the past 24 hours. Three little islands of epithelium have made their appearance near the center of the groin lesion. The epithelium from the edges is growing inward. The lesion on the prepuce is definitely smaller, and the amount of induration is decreased, allowing further retraction of the prepuce. 0.08 gram tartar emetic intravenously. No reaction. February 18, 1921, color of granulations is changing from beefy-red to salmon color. Decrease in size of lesion continues. 0.08 gram tartar emetic intravenously. No reaction. February 21, 1921, 0.08 gram tartar emetic intravenously. No reaction. February 22, 1921, 0.10 gram tartar emetic intravenously. No reaction. February 23, 1921, 0.10 gram tartar emetic intravenously. No reaction. February 24, 1921, 0.10 gram tartar emetic intravenously. No reaction. Epithelium has continued to proliferate actively. The islands in the center of the groin lesion now measure ½ by 8 centimeters. No systematic effect noted from injections. Dosage of 0.10 gram given on following dates, March 2, 3, 4, 7, 8, 9, 16, 19, 23, 26, 29, 31, April 11, 15, 19, 26, May 4, 14, 23. May 9, 1921, lesion so far healed that patient was prepared for circumcision and same successfully performed.

CASE 2. M. S., female, negro, age 21, admitted November, 1920, complaining of genital sores. Born and lived in Philadelphia, married, has had three full term pregnancies. Since initial sexual act in 1914, has had yellowish vaginal discharge and 1 month following this the right labium majorum enlarged, and within 1 week, it had become such a size as to cover the opposite labium. It was not painful, nor was there any visible excoriation, abrasion, ulceration, or bleeding. This condition persisted for 1 month, then disappeared in 2 weeks time without any treatment. In December, 1917, she experienced a stinging sensation again in the right labium and found a small "pimple-like" sore there which she broke. Following this several similar sores formed, rather slowly, and coalesced. There was no soreness with these lesions until after 3 months, at which time patient was admitted to the Philadelphia General Hospital (February 13, 1918) because of condition of vulva and 8 months' pregnancy. On examination, pudendal lesions and a left bubo considered syphilitic, Wassermann reported 4+. She was given five doses of arsenobenzol and discharged from hospital, June 20, 1918, having been delivered of a living child, the bubo healed and vulva nearly healed. Patient describes this first lesion as being red, lumpy, bleeding easily, growing rather rapidly and raised off the surface of the skin. During the summer of 1918, she attended the dispensary regularly for antisyphilitic treatment. July 11, 1919, she was readmitted to the hospital. The following notes have been extracted from her history. Complaint, sores on privates which began to break out as soon as she left hospital last year; they have steadily grown worse to date. General appearance is emaciated. Labia are swollen and ulcerated at anus, inguinal lymph glands are markedly swollen. Purulent discharge from vagina. September 11, 1919, labia majora were much swollen; right labium has tumor mass on it, which is hard, firm, not tender. Lower third is denuded of epithelium, on cleansing shows surface ulcerated and granulating. Left labium less swollen than the right, has a soft tumor, tender on pressure: lower fourth ulcerated and granulating. Urethral orifice surrounded by soft, tender, finger-like processes. Inguinal glands much enlarged; ulcerated on left side and nearly healed. Gland on right side open and ulcerating. December 14, 1919, the condition has been pronounced tuberculosis cutis by genital-urinary chief, and syphilis by the skin chief. Patient has had marked antisyphilitic treatment with no improvement. *Laboratory report.* Histological reports: tissue resembles, or is, epithelioma. Bacteriological reports: no tubercle bacilli found in smears. Blood Wassermann, July 12, 1919, 4+. September 18, 1919, negative. October 27, 1919, negative. January 31, 1920, 1+. Constant irregular fever with slight increases in pulse and respiration of irregular character. Fever seldom at or above 101°. Treatment has been practically antisyphilitic all the way through, although five X-ray applications were made, evidently with lupus vulvæ in mind. Patient was discharged in January 1920.

At time of third admission in November, 1920, the patient was in a weakened and emaciated state, her

appetite a capricious affair, she was fretful and nervous, found it difficult to sleep, and had to be moved with extreme care, because of the pain in a very much hypertrophied vulva, the surface of which was granular, nodular, with a tendency to bleed at the slightest provocation. The diagnosis of tuberculosis of the vulva made on her previous admissions was adhered to once more, and confirmed by chief of service. X-ray treatments were instituted at once; she was sent to the X-ray department every 3 weeks, and by the middle of January, 1920, there was evidence of improvement, noted more especially in regard to her general condition, than in the appearance of the local lesion, in fact it was noted on her chart that the granular process on the vulva was becoming more extensive. A section taken in December, 1920, for histological examination was reported as follows: "Tissue shows considerable proliferation of the squamous cell layer, which extends rather deeply into the underlying tissue. No pearls are present; otherwise the section shows a diffuse infiltration by polymorphonuclear cells and there is considerable free hæmorrhage. Diagnosis: chronic inflammatory tissue; suggests lupus. Stain for tubercle bacilli is negative." The latter part of January, 1921, a tentative diagnosis of granuloma inguinale was made, and confirmed by laboratory methods (smears and section). The patient's condition at the time the intravenous injections of the tartrate of antimony and potassium were started, was very poor; she was extremely emaciated, weighing but 87 pounds, the pale color of all of her mucous membranes favored a rather severe secondary anæmia, and, as stated before, she had a rather poor appetite, was irritable and easily hurt when moved. The lesion locally, as follows: *Left inguinale region:* an area 2 centimeters above the Poupart's ligament and parallel with it; measured 7 centimeters in length and varies from 0.5 to 1.5 centimeters in width. The border is irregular in outline, but very definitely raised off the surface of the skin; the color is a vivid red, with small bleeding areas here and there, where the surface has been abraded slightly by the removal of bandage. The surface has a nodular appearance, is slightly moist; there is no evidence of ulceration, the whole affair is a marked piling up and proliferation of granulation tissue. There is a peculiarly offensive odor when the lesion is exposed. No enlargement of the inguinal glands noted. At the borders of the diseased area, there is some evidence of beginning cicatrization. The consistency of the process shows a rather firm tissue, which does not give much pain when the patient is unaware that it is being manipulated. *Right inguinal region:* An elevated scar in practically the identical position as the opposite side, 5 centimeters in length and 0.5 centimeter in width. At the inner end of this cicatrix is an active condition as above noted, circular in form and in size, one-half the area of a dime. *Vulva, perineum and nates:* The entire left labium majorum is covered by this granular tissue, and the opposite labium shows only a very small area of healthy and intact skin. The labia minora are moderately involved, as is the lower part of the vaginal wall. The granulations are continuous onto the perineum on the right side of the cleft, extending as far back as the anus. The vulva is much hypertrophied, the surface is nodular, moist, raw beefsteak appearance and bleeding at various points; the color is reddish, the odor offensive, the border sharply defined from the healthy skin and seripiginous in outline. The tissue has a firm feel and does not cause patient any discomfort when manipulated with moderate care. At the junction of the thighs and the vulva, the condition is present on the limbs, extending only where the vulva comes in contact with the thigh.

Laboratory notes: January 24, 1921, smear—gram positive bacilli; gram negative bacilli. Fontana stain—no spirochætæ. Giemsa stain—no granuloma bodies; no spirochætæ; few polymorphonuclear and mononuclears. Cultures—staphylococci, diphtheroids, streptococci, and a large gram positive encapsulated bacillus (unidentified). January 28, 1921, smear—gram stain—gram positive bacilli and diplococci. Gram negative bacilli. Cultures—plate overgrown with bacillus proteus. Smears show gram negative bacilli, staphylococci and diphtheroids. February 1, 1921, cultures on Sabouraud's medium show no growth after 72 hours. February 15, 1921, hæmoglobin, 70 per cent; red blood cells 3,470,000; white blood cells, 7,000; polymorphonuclears, 46 per cent; lymphocytes, 46 per cent; mononuclears, 3 per cent; transitionals, 3 per cent; eosinophiles, 2 per cent; marked anisocytosis, polychromatophilia, poikilocytosis. March 2, 1921, hæmoglobin, 40 per cent; red blood cells, 3,370,000; white blood cells, 6,600; polymorphonuclears, 45 per cent; lymphocytes, 49 per cent; transitionals, 2 per cent; eosinophiles, 3 per cent; basophiles, 1 per cent. Stipple cells, anisocytosis, polychromatophilia, and achromia. March 9, 1921, blood platelet count—410,000. March 22, 1921, fragility test—complete hæmolysis, 0.20; complete inhibition, 0.44. April 1, 1921, hæmoglobin, 55 per cent; red blood cells, 3,720,000.

Histopathology. Section from granulating area taken January 28, 1921, fixed in Schaudin's solution, stained with Giemsa's stain. Histological picture as above described. Smear stained with Giemsa's stain negative for encapsulated organisms.

Treatment. Treatment for granuloma inguinale was instituted January 29, 1921, the tartar emetic being prepared in 1 per cent solution in sterile water, beginning with a very small dose and increasing gradually each day until maximum dose was reached. January 29, 1921, injected 0.02 gram. No constitutional reaction; during the afternoon, the diseased area was itching continuously. No headache, nor pains in any of the bones of body. January 31, 1921, injected .025 gram. Three minutes following injection, patient complained of dizziness and sensation of fainting, but recovered rapidly; probably due to injecting the solution too quickly. She had a headache during the afternoon and evening, and considerable itching in the lesion. February 1, 1921, injected .03 gram. Drug injected a good deal slower than was done yesterday and no reaction occurred on the table. There is considerable itching beginning 4 hours following administration of solution, and stab-like stinging occurs every few moments, both lasting until about bed time. There is a great deal of secretion on the surface of the granuloma this morning, and the odor has become more marked. Patient complained of headache at vertex following the evening meal. February 2, 1921, injected. 035 gram. The itching and stinging continue, commencing 3 or 4 hours after the injection. There was a good deal of pus-like material on the bandages this morning and much moisture over all of granuloma. February 3, 1921, injected .04 gram. Complains of itching and stinging in the lesion a few hours after injection. The solution causes a good deal of pain in arm and shoulder as it is being injected. Needle slipped out of vein and a bit of drug was injected into tissues; patient immediately cried with pain; hot water bag kept on arm all day. February 4, 1921, arm is slightly swollen and indurated at site of yesterday's injection, where solution went into tissues; very little pain and no sign of abscess. Complains of itching and especially stinging in the granuloma, the surface of which is very moist and bleeds extremely easy. There are several small white areas about the size of a small pea forming in various parts of the growth. At the edges of the healthy skin, new epithelium may be seen growing in over the granulation tissue. Dur-

ing the afternoon the patient complained of a severe backache. February 5, 1921, injection .05 gram. The whole surface of the granuloma is extremely moist, and the odor is very offensive. Considerable stinging is complained of locally. The serum or exudate from the growth stains the pad a pale yellow. February 7, 1921, injection .055 gram. February 8, 1921, injection .06 gram. Complains of itching and stinging, and a good deal of pain is present in the arm and shoulder when the drug is being injected. February 9, 1921, injection .07 gram. Does not note as much itching the last couple of days but the stinging does not abate any. Still complains of immediate pain and stinging up arm and shoulder as the solution is administered. February 10, 1921, injection .075 gram; February 11, 1921, injection .08 gram; February 12, 1921, injection .08 gram; February 14, 1921, injection .05 gram; February 15, 1921, injection .08 gram. Severe vertical headaches and the usual stinging; very little discharge and odor is lessening. There is a considerable amount of new epithelium making its appearance at the outer borders of the granuloma and around the small white patches that made their appearance the third day. February 16, 1921, injection .05 gram. Has had nose-bleed on three successive nights, but not severe. February 17, 1921, no especial complaint, patient is out of bed for past few days, the first time since admission in November. Her appetite and disposition have undergone a marked change for the better. February 18, 1921, injection .10 gram. February 19, 1921, injection of .11 gram. Epithelium is advancing daily and has covered a large portion of the granuloma; marked general improvement also. February 21, 1921, injection .11 gram. February 22, 1921, injection .12 gram. February 24, 1921, injection .08 gram. Changed from sterile water to normal saline to make the solution, and the pain in the arm and shoulder was not noticed by the patient, in fact she seemed to complain much less all the way through the day, than when the sterile water solution was used. February 26, 1921, injection .05 gram. The inguinal region has entirely healed and the vulva is rapidly approaching the normal once more. Injection .05 gram was given on the following dates: March 3, 8, 10, 12, 15, 23, 26, 29. The total amount of tartrate administered to date, 1.96 grams. The general condition of the patient is extremely good, appetite is excellent, excretions give no trouble, sleeps well, and irritability has disappeared. When she was admitted in November she weighed but 87 pounds; March 8, weight had increased to 99 pounds, and on April 21, a further increase to 106 pounds was registered. She had gained no weight up to the time the administration of tartar emetic was instituted. Three blood Wassermann tests November 11, 1920, December 27, 1920, and February 24, 1921, were all reported negative in all antigens. All urine reports have been normal; catheterized specimens were taken. April 23, 1921, received .10 grams of the drug intravenously, making the thirty-third injection. She has been discharged and will report to the venereal dispensary once weekly for continued treatment. The growth on the vulva and in the inguinal region has entirely disappeared, healing with considerable scarring, the cicatrix being slightly elevated. There are two or three small areas between the vulva and the thigh, and in the region of the fourchette that have not entirely healed, the largest of these is about the size of a dime. Patient followed to date (October, 1921). Has continued treatment as prescribed. No recurrence and has continued to gain in weight and general health.

Case 3. G. J., male, negro, age 37, admitted May 19, 1920, complaining of sore in groin. Born in Virginia. Patient has traveled as a sailor to tropical ports. Seven years ago he had a sore on the foreskin. Several weeks later he developed a right-sided bubo, which was incised and drained. This healed without incident, broke down again 3 weeks later, but healed soon and has remained well since. Present condition started about 6 years ago, when there appeared two small pimples at the hair margin above the pubis and a little to the right of the mid-line. One of these healed up but the other enlarged and finally broke down, discharging some pus and rapidly forming exuberant granulations. This tissue spread throughout the right groin. Two years ago the entire growth was excised. The operative wound healed almost completely, except a small crusted center spot, and under this crust granulations again formed and began to spread. Soon the entire groin was involved and the granuloma extended down to the fold between the scrotum and the thigh on the right side. Six months ago X-ray treatment was begun and the condition has slowly progressed toward healing. February 10, 1921, patient is an employee of the hospital. The right groin and iliac region shows a large tense scar, part of which is devoid of pigment, extending from the symphysis to the iliac bone and measuring about 2½ inches in diameter. At the side of the scrotum the scar passes down the inguinal fold to the perineum, just posterior to the scrotum. At two places in this scar there are unhealed, active, lesions. One near the anterior superior spine, measuring 1 by 1½ inches in size. The granulation tissue over it is not exuberant, but lies flush with the surface of the skin, and is moist. (The effect of X-ray treatment.) The other area lies near the posterior part of the scar, in the fold between the scrotum and the thigh. This shows a sinus about one quarter of an inch deep, admitting only a probe point but discharging pus constantly. The area immediately around this opening is raw and abraded and shows an area of granulations about the size of a dime.

Treatment. On February 11, 12, 14, 15 and 16, 0.05 gram of tartar emetic was given intravenously. After the third injection, the upper lesion became dry and crusted over. The patient suffered some rheumatoid pains about right shoulder joint, painful to motion, but without local symptoms. Some of last injection was spilled into tissues. February 17, 1921, 0.08 gram of tartar emetic intravenously. February 21, 1921, abscess at point of injection where tartar emetic was given extravenously. Same incised. Given 0.08 gram today. February 25, 1921, 0.06 gram given today. Arm healed; upper lesion completely covered with epithelium; lower seems $\frac{1}{8}$ inch in depth and no exudate. On February 26 and 28 and March 2, given 0.06 gram of drug. March 3, 0.07 gram of tartar emetic intravenously. March 4, 0.08 gram of tartar emetic intravenously. March 7 and 8, 0.09 gram of tartar emetic intravenously. March 9, 16, 19, 23, 26, and April 11, 15, and 19 given 0.10 gram of tartar emetic. Patient has been under observation to date (October, 1921) without recurrence.

Case 4. E. C., female, negro, admitted December, 1920, complaining of sores about vulva. Patient born in Virginia and moved in early life to Philadelphia, where she has lived ever since. Present condition started in August, 1918, with profuse vaginal discharge. In September, 1918, first noticed swelling in left groin which reached the size of a hen's egg. In October, 1918, several small pea-sized papules, grayish in color, were noticed upon left labium majorum and on the mons pubis. These itched and on breaking them exuded a watery material. They crusted over, did not heal, coalesced, and resulted in a moss-like, raw mass that bled on the slightest injury. She confesses to coitus 9 days before the development of these pimples. She was admitted to the Philadelphia General Hospital October 23, 1918, found to have Wassermann 1+. Given six injections of arsenobenzol, 14 intramuscular injections

Fig. 5 (at left). Case 1. Condition of patient on January 13, 1921. Groin, prepucial, and perineal involvement. Duration 8 months.

Fig. 6. Case 1. Condition of patient April 23, 1921. Lesions healed in 46 days. Has had 21 injections, total of 1.82 grams of drug. Note that scar tissue in the negro appears white.

of mercury salicylate (1 grain), and potassium iodide up to 150 grains daily and discharged on February 20, 1919, healed but with marked induration of right labium. She remained well for 1 year, but suffered a return of the original vulva sores in October, 1920, and was readmitted to hospital in December, 1920. Lesion described as follows: No evidence of bubo and groins free of disease; an elevated mass of granulation tissue covers the left labium, the mons pubis, and greater portion of right labium. Right labium markedly hypertrophic. The general appearance of the growth is pale red in color, with small bleeding areas at various points; the surface tends to be nodular, is shiny, and presents a moderate amount of moisture. There is no evidence of ulceration, the condition being elevated, proliferative, and with no sign of sloughing at any point. It is firm and gives but slight pain on handling. The lesion extends slightly onto the thighs where touching the enlarged labia. General condition of patient extremely poor, has lost at least 30 pounds in weight, appetite lost, strength gone and confined to bed greater part of time.

Laboratory notes. Section of tissue taken in December, 1920, reported: Chronic inflammatory tissue with areas of degenerated fibrous and epithelial tissue; not tuberculous. December 27, 1920, blood Wassermann test, 3+. December 30, 1920, blood Wassermann test, negative. February 24, 1920, blood Wassermann, negative. January 24, 1920, smears gram stain—gram positive diplococci and large bacilli. Gram negative diplococci and bacilli. Fontana stain—no spirochætæ or spirilla. Giemsa stain—no granuloma bodies. Cultures—diphtheroids and bacillus coli. January 28, 1921, smears—gram stain—gram positive bacilli and diplococci, gram negative bacilli. Giemsa stain—no granuloma bodies or spirochætæ. Cultures—overgrown with bacillus proteus. February 1, 1921, cultures on Sabouraud's medium no growth after 72 hours. February 9, 1921, smears—positive for granuloma bodies; stained with Wright's and Giemsa and showed many intra- and extracellular organisms, diplococci, and encapsulated. February 15, 1921, hæmoglobin, 50 per cent; red blood cells, 3,820,000; white blood cells, 9,200; polymorphonuclears, 46 per cent; lymphocytes, 43 per cent; mononuclears, 4 per cent; transitionals, 5 per cent; eosinophiles, 1 per cent; basophiles, 1 per cent; marked asinocytosis, polychromatophilia, achromia, and poikilocytosis. March 2, 1921, hæmoglobin, 30 per cent; red blood cells, 3,450,000; white blood cells, 5,000; polymorphonuclears, 36 per cent; lymphocytes, 63 per cent (50 per cent large) eosinophiles 1 per cent; polychromatophilia, asinocytosis, stipple cells, occasional normoblast. March 9, 1921, blood platelet count—380,000. March 22, 1921, fragility test: complete hæmolysis, 0.20; complete inhibition—0.46. April 23, 1921, red blood cells—3,380,000; hæmoglobin, 58 per cent.

Treatment. February 11, 1921, gram 0.03 tartar emetic given intravenously. February 12, 1921, 0.04 gram of tartar emetic given intravenously. February 14, 1921, 0.05 gram of tartar emetic intravenously. February 15, 1921, 0.06 gram of tartar emetic intravenously. February 16, 1921, 0.07 gram of tartar emetic intravenously. February 17, 1921, 0.08 gram of tartar emetic intravenously. On February 18, 19, 21, 22, 23, 24, and 26, was given dose of 0.08 gram; on February 28 and March 1, this was increased to 0.10 gram. On March 3, 8, 10, was given 0.08 gram and on March 12, 15, 18, 20, 23, 26, 30, and April 5 and 12, 0.05 gram were given. On April 20, 22, was given 0.06 gram. Total of 1.90 grams administered in 29 doses. Reactions from the drug never amounted to more than local stinging, itching, and throbbing in lesion immediately following injection. No generalized symptoms of toxic effects of drug. The granuloma has almost entirely disappeared except for a very small area in right labium that seems resistant and extremely firm. Healing was fairly rapid, leaving a slightly raised scar and markedly indurated labia. Patient's general condition greatly improved, appetite excellent, sleeps well, works about ward all day and has gained 25 pounds in weight. She is to receive 6 to 8 further injections and then be discharged to Out Patients Department.

CASE 5. H. J., male, negro, age 24, admitted February 22, 1920, complaining of a large sore in left groin. Patient was born in Maryland. Lived all his life about Baltimore, Centreville, and Philadelphia, never further south or outside of the country. Onset of the present condition was 3 years ago, when patient developed two small "pimples" on the inner surface of the foreskin. These remained for some time, and gradually increased in size, later breaking down and spreading slowly around the entire foreskin. Several weeks after these "pimples" appeared the glands in both groins began to swell. They receded under iodine treatment, later returned, receded a second time and about 6 months later became large and required incision. Following the drainage the right groin healed. The left, when almost healed, developed "proud flesh" and started to spread down the groin and into the fold between the

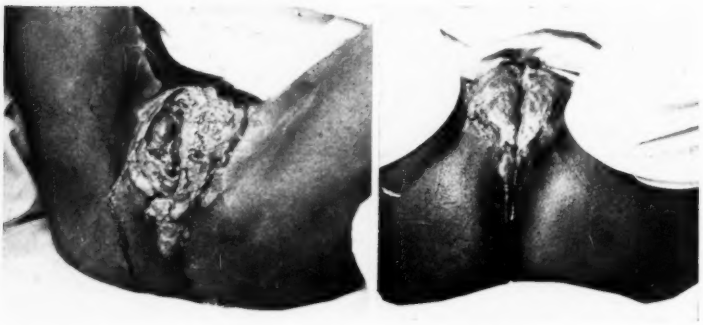

Fig. 7 (at left). Case 2. Pitiable condition of patient on January 28, 1921. Was not expected to live. Duration 3 years and this the third recurrence.

Fig. 8. Case 2. Result of 32 doses, totalling 1.96 grams of tartar emetic. Picture taken April 23, 1921. Lesion entirely healed in 59 days. Some induration remaining. General condition normal. Gained 19 pounds in weight.

thigh and scrotum. Over the perineum and about the anus, "bumps" appeared, which later broke down and coalesced. At present, in the region of the left inguinal glands at the seat of the old scar of a bubo, is a grayish, elevated, granulating mass, extending down between scrotum and inner side of thigh to the perineum, where it spreads to the width of 2 inches in diameter. It is sharply defined and is a constructive growth involving only skin surface, but in the region of the perineum a large ulcer is making its way into deeper tissues. Foreskin is long and can be retracted, and there are several granulating masses, resembling those in the groin, on the mucous membrane of the foreskin. NOTE.—This patient entered the hospital one year ago. He has been receiving X-ray exposures once every 3 weeks. Wound today (February 11, 1921) extends from within 1.5 inches of the left anterior superior spine, downward along the groin and scrotum to the posterior margin of this structure, it crosses the natal cleft, and involves the greater part of the urogenital triangle. The edges are raised and indurated and show evidences of slowly proliferating epithelium. The center of the lesion is moist, oozing, and granulating. The entire process is quite painful, especially at night and when the patient walks he has to assume a stooped position with legs spread widely apart. There is considerable offensive discharge from the surface of the perineal granulations.

Treatment. Given 0.05 gram of tartar emetic on February 11, 12, 14, 15, and 16. There has been a marked decrease in the discharge and the perineal region is covered with dry crusts for the first time in one year. Epithelium is definitely and rapidly growing inward from the edges and several isolated areas are proliferating epithelium at the base of the scrotum. The raised granulations are lower and there is much less pain. Given 0.08 gram dosage on February 17, 18, 21, 22, and 23. He has had some soreness and stiffness in shoulders and back on the mornings after injections, that decreased after being up and about. Epithelium continues to spread inward from all edges, induration is less, exudate decidedly less, and pain progressively decreasing. Given 0.10 gram on Feb-

Fig. 9. Case 3. Old lesion of 6 years duration. Almost healed under persistent X-ray treatment. Picture taken January 13, 1921. Healed in 19 days. Patient has been observed to date (October, 1921) and so far has been without recurrence.

Fig. 10. Case 4. Condition January 28, 1921. This lesion is entirely raw, blood red, with extensions in left groin. Duration 3 years, and this is the third recurrence. Healed on April 23, 1921, after 29 doses of tartar emetic totalling 1.90 grams in 70 days. Labia remained markedly elephantic.

Fig. 11 (at left). Case 5. Condition of patient January 13, 1921. Lesion extending from anterior superior spine to anus. Patient could not walk up stairs. Duration 3 years.

Fig. 12. Case 5. Picture taken March 30, 1921. Lesions healed in 49 days. Has had 23 doses totalling 1.85 grams of tartar emetic. (Scar tissue appearing white.)

ruary 24 and 25. On February 26 was given only 0.06 gram because of persistent bone aches. On February 28 and March 3 dosage of 0.08 gram given. Note on February 27 states that for the past 2 days healing has become accelerated; perineal lesion is now half covered with epithelium; induration is progressively subsiding and patient feels quite well and can walk almost normally. Given 0.09 gram on March 4 and full dosage of 0.10 gram on March 7, 8, 9, 16, 23, 26, 31 and April 11, 15, 19, and 24. April 24, 1921, lesions are completely healed but treatment will be continued. Patient in excellent condition. Discharged today to the pay roll of the hospital as an employee.

Case 6. W. F., male, negro, age 55, admitted February 26, 1921, complaining of growth about anus. Born in Pennsylvania where he has lived all his life. Unmarried and denies venereal disease. Present condition started a little over 2 years ago with slight bleeding, soreness, and distress when at stool. The proliferative growth has increased in size gradually and without recession until the present. There is no pain, soreness, itching or discomfort at present. Occasionally there is slight bleeding from prolonged work (porter) and friction of the parts. Appetite is good, bowels move daily, no loss of weight. On examination, external genitalia and groin are normal. The posterior raphé of the scrotum shows the beginning of a proliferative growth that forms two masses encircling the anus and completely filling the perineum and intergluteal region. The surface is made up of "tubercles" of new-growth, each about the size of a pea and the surface of each is covered with a pearly head of white epithelial tissue. It is painless, and is bathed in a slight serosanguinous secretion. The anal orifice is invisible.

Note.—This patient was admitted to the dermatological ward, where he was given three intravenous injections of neoarsphenamine (gram 0.90). His Wassermann twice taken was negative and no improvement in the local condition was observed. At our suggestion he was given one injection of tartar emetic, 0.05 gram and then transferred to our wards.

Laboratory notes. February 1, 1921, smear from lesion—negative for granuloma bodies. Cultures on Sabouraud's medium negative after 72 hours. February 7, 1921, smear from lesion—granuloma bodies present. No spirochætæ. Various bacteria. Cultures negative for Friedlaender-like bacillus. March 14, 1921, blood count—hæmoglobin, 55 per cent; red blood cells, 4,070,000; white blood cells, 10,800; polymorphonuclear, 71 per cent; lymphocytes, 20 per cent; eosinophiles, 7 per cent; transitionals, 2 per cent.

Histopathology. Section from granulations. Fixation in formalin and Schaudin's solution. Stained with hæmatoxylin and eosin, and Giemsa. Typical of picture described. In addition there was marked proliferation of squamous epithelium in long processes possessing hyperchromatic cells. Section taken from granuloma, February 17, 1921, fixed and stained as above. Structure as above, except that there was no marked proliferation of the squamous epithelium. A few bipolar bacilli seen in endothelial leucocytes.

Treatment. Tartar emetic was given intravenously as follows: 0.05 gram March 2, 1921; 0.06 gram, March 4; 0.07 gram, March 7; 0.08 gram, March 8; 0.09 gram, March 9, with no reaction following injections. This patient has been perfectly tolerant to the rapid increase in dosage. He has not had any symptoms of reaction from the drug at any time. The lesion shows marked and rapid improvement, has decreased in size and especially flattened as though the new-growth was actually absorbing. The raw surfaces deep in the crypts between the proliferated tubercles have less discharge, and epithelization is progressing rapidly. 0.10 gram of drug was administered on the following dates: March 16, 19, 23, 26, 31, and April 11, 15, 19 and 23. April 23, 1921, patient has now received fifteen injections of the tartar emetic. He has shown no reaction to this drug save an almost complete disappearance of his granuloma. There are no raw surfaces remaining and the epithelium is smooth and healthy everywhere. Discharged under promise that he will continue weekly injections in the Out Patient Department.

Note.—Patient returned in September, 1921, with recurrence at ventral edge of anus. Had not kept up his Dispensary Treatment as advised.

Case 7. B. A., male, age 43, admitted February 26, 1921, complaining of recurrent sore on penis. Patient was in hospital last year for the same condition which was relieved by X-ray. Born in South Carolina, but has lived in Philadelphia during the past 20 odd years, and condition developed while a resident of Philadelphia. The lesion appeared for the second time 2 months ago, as a simple "pimple" on the glans penis. This grew in size until as big as a finger nail, when it broke down and became an open sore. There has been no pain, no discharge of pus from it, but a continual oozing of bloody serum. It has increased in size very gradually. It appears as a sharply defined, raw area over glans penis and extending up about

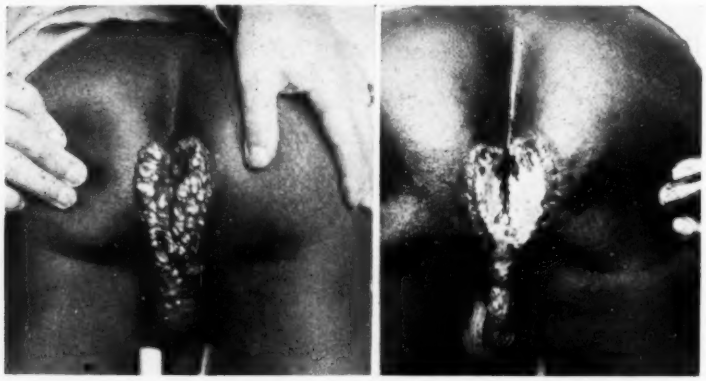

Fig. 13 (at left). Case 6. Lesion limited to anal region and of 2 years duration. Picture taken January 21, 1921.

Fig. 14. Case 6. Result of treatment: Patient has received 20 doses totalling 1.07 grams of tartar emetic. Picture taken May 14, 1921. Healing complete in 37 days.

1 inch on shaft of penis, is not ulcerated, but covered with clean granulation tissue. The mucous membrane is destroyed, leaving a raw, red, oozing surface studded with tiny heads of granulation tissue. It is painless, odorless, and free of discharge.

Laboratory notes. March 1, 1921, Wassermann, negative. Smear positive for typical intracellular organisms. Urine analysis negative. Blood count: hæmoglobin, 82 per cent; red blood cells, 3,950,000; white blood cells, 7,650; polymorphonuclears, 57 per cent; lymphocytes, 36 per cent; mononuclears, 1 per cent; eosinophiles, 4 per cent; basophiles, 2 per cent. March 2, 1921, smears from lesion—positive for granuloma bodies. Cultures, negative for Friedlaender-like bacillus. March 7, 1921, smears from lesion—positive for granuloma bodies. Cultures, negative for Friedlaender-like bacillus. March 11, 1921, smears from lesion—positive for granuloma bodies. Cultures, negative for Friedlaender-like bacillus. Fragility test: complete hæmolysis, 0.28, complete inhibition, 0.40. Blood platelet count, 247,000. March 12, 1921, smears from lesion, positive for granuloma bodies. Cultures negative for Friedlaender-like bacillus. April 4, 1921, smears from lesion, after four injections—negative for granuloma bodies. Cultures—negative for Friedlaender-like bacillus.

Histopathology. Section from margin of lesion taken March 2, 1921. Fixation as outlined and picture typical of original description.

Treatment. Patient was given tartar emetic intravenously 0.05 gram March 23, 1921; 0.06 gram March 25;

Fig. 15. Case 7. Lesion of glans and foreskin only. Duration 2 months but this is a recurrence of a primary attack. Healed in 69 days with 10 doses totalling .85 gram of tartar emetic. Picture taken March 30, 1921, after third injection had been given.

Fig. 16. Case 8. Old lesion of 2 years duration. Almost healed with X-ray. Note double groin involvement and marked induration of foreskin. This induration was greatly reduced by treatment. Picture taken March 30, 1921, after 14 injections of tartar emetic and completely healed. Treatment has been persisted in, and there has been a decided diminution in the heavy induration of the foreskin.

Fig. 17. Case 10. Condition of patient end of February, 1921. Duration one year. Healed in 42 days, having received 17 injections totalling 0.94 gram tartar emetic.

Fig. 18. Case 12. Lesion of glans and foreskin only. Duration 4 years. Healed in 28 days with 8 doses of sodium antimony thioglycollate, totalling 0.68 gram of drug. Picture taken May 11, 1921, before starting treatment.

0.07 gram March 26, and 0.08 gram March 31. Patient has had some rheumatoid pains in shoulders and slight swelling of feet that has made caution necessary with medication. No alarming symptoms, and condition improving rapidly. On April 11, 1921, 0.09 gram of tartar emetic was given intravenously; April 15, 0.10 gram and the same quantity on April 19. Patient has a conjunctivitis and nasal congestion. Injection stopped. Lesion practically healed. On May 9, 23, and 31, 0.10 gram of tartar emetic was injected intravenously. Patient has had ten injections of the drug. Over the lesion on the foreskin a new epithelium has formed entirely; the glans penis is entirely healed except for a narrow sore on the back of the glans about 1/8 inch wide and 3/4 inch long; this is dry, level with the remaining surface and apparently on the verge of complete healing. Patient up and about in good condition, wishes his discharge, and agrees to come to the dispensary for further injections.

Case 8. W. H., male, age 39, admitted June 30, 1920, complaining of a sore in groin and inguinal fold. Has been living in Philadelphia for the 2 years prior to the onset of the present condition, which started about December 1918, with a sore on the base of the shaft of the penis. This was pronounced a soft sore and not luetic. It did not heal and about 6 months later the condition broke out in the right groin and has remained as an open lesion ever since. Patient is an unusually fine physical specimen of negro, of almost gigantic development. General physical examination is negative. Genitalia show a raw ulcerated area about the root of the penis and in the right groin extending down to the fold between the scrotum and the thigh. It is raised about the edges and of deep red color, not undermining, and free of discharge or odor. Patient was placed under X-ray treatment for "tuberculosis cutis," receiving exposures every third week. On June 30, 1920, improvement is noted. On August 23, 1920, condition recorded such that he is able to work and patient discharged from the ward to the payroll and put to work in the kitchen.

February 11, 1921. Physically, patient is in excellent condition except for lesions about genitalia. Here there is marked infiltration and scarification of the skin over the base of the penis, resembling elephantiasis. Foreskin is very indurated, hard, and painless; it cannot be retracted. On right inferiolateral aspect about the middle of the shaft is an oblong ulcerated area lying in the middle of a white, indurated, and painless scar. It is 1.5 by 1 centimeter in size, and of a raw, red color. There is a similar, but larger, area on the right side of the scrotum in the inguinal fold; it is moist, bleeds easily on manipulation, flesh is red in color, and is covered with a thin, purulent exudate.

Treatment. On February 11, 12, and 15, 0.05 grams of tartar emetic were given intravenously. Patient says sores are better than at any previous time. Both are covered with a light crust, perfectly dry and epithelium is commencing to proliferate. On February 16, 1921, 0.05 gram of tartar emetic was injected intravenously; on February 17 and 18, 0.08 gram. The lesions are much smaller and induration seems softer. On February 21, 1921, 0.08 gram of tartar emetic was given intravenously. Ulcer on penis healed today. On February 23, 1921, 0.08 gram of tartar emetic was given intravenously and on February 28, 1921, 0.10 gram. Induration of foreskin is rapidly disappearing. The ulcer in groin is scabbed over and apparently healed though not disturbed. Patient has not had any reaction to the medication at any time. Treatment persisted in and on the following dates 0.10 gram of tartar emetic was given: March 2, 3, 4, 7, 8, 9, 16, 19, 31, and on April 11 and 19.

Note.—October, 1921. It is of interest to note that treatment has been so satisfactory to the patient that he persisted in its administration long after he was healed with the result that there has been a marked decrease in the heavy elephantic induration of the skin and foreskin of the penis.

Case 9. W. P., male, age 26, admitted April 28, 1920, complaining of a sore in left groin. In August, 1919, he contracted a sore on the penis and some time after a generalized eruption. In the last 2 weeks he developed enlarged glands in the left groin, which were opened 1 week ago and have been discharging since. There is also a sore on the penis that has been present for the past 4 weeks. With the exception of scars from sinuses and indurated glands of neck, and evidence of infiltration of both apices, general physical examination otherwise negative. There is a phimosis with slight purulent discharge from foreskin. In both inguinal regions are large masses of lymph glands densely matted together, while on the left is a particularly large mass with sinus formation from which pus exudes. Patient was circumcised at this time

Fig. 19.

Fig. 19. Case 14. Picture taken April 12, 1921. Duration 7 months. Patient has received all forms of local antiseptics and dressings, without benefit. Has had repeatedly negative Wassermann tests, but nevertheless, was first given intensive antiluetic treatment during following 3 months and showed no improvement.

Fig. 20.

Fig. 20.

Fig. 20. Case 14. Picture taken September 16, 1921, after persistence on tartar emetic injections over 6 weeks. Dose of 0.06 gram was given every 2 days, and he is still undergoing treatment. In all probability he has had a double infection.

(April, 1920) and given 8 doses of neosalvarsan, and on August 24, 1920, he was healed and symptomless (except as noted below) and was then placed on the pay-roll of the Institution.

February 2, 1921: This man is an employee at the firemen's and officers' mess. He has been kept in the institution in order to receive X-ray treatment every 3 weeks, for unhealed condition in groins considered at the time to be tuberculosis cutis. His general physical examination is negative, he is well nourished and developed and apparently in good health. The lesions in the groins have slowly cicatrized with the exception of an ulcer at the base of the scrotum on the right side about the size of a kidney bean, and on the inside of the left thigh, where it comes in contact with the scrotal lesion, are found four raised areas, sharply defined, plateau-like, about 1½ centimeters in size. These latter lesions are covered by very thin epithelium and on two of them where the epithelium has been rubbed off typical granulation tissue is present. Patient states they are new lesions beginning to develop, as others have done before.

Treatment. On February 2 and 12, 1921, 0.05 gram of tartar emetic was injected intravenously; on February 18, and on February 28, 0.10 gram.

April 11, 1921, patient healed so rapidly after above treatment that he neglected his injections. Today there is a recurrence of similar lesions on the thigh. He was given 0.10 gram of tartar emetic intravenously. April 19, 1921, 0.10 gram of tartar emetic intravenously.

NOTE.—This patient is an employee of the hospital. He has persisted in his treatment and has remained perfectly healed to date (October, 1921).

CASE 10. M. W., female, age 20 (from the service of Dr. A. H. Lippincott, Cooper Hospital, Camden, New Jersey), admitted February 8, 1921, presenting extensive lesions about genitalia. Past history unimportant. Present condition of 1 year's duration, commencing as a small nodule on the right labium majorum, which ruptured and then started to proliferate, and has gradually involved the entire vulva and perineum. The rapidity with which this extended varied, but at no time did it show any tendency to heal spontaneously, and patient has not received any medical treatment for the condition. There has been a rather constant, profuse, foul-smelling, and at times blood-tinged discharge. Chest examination showed evidences of pulmonary tuberculosis at both apices. The vulva lesion presents a large, raw mass covering both labia, and extending from the symphysis to the perineum, it follows the labia down into the vagina and extends into the anus posteriorly for about 1.5 inches. Cystoscopic examination is negative. Histological examination was made of section of tissue removed from the right labium. At the same time smears were taken from the area of excised tissue. Microscopic examination showed a marked round-cell infiltration. Polymorphonuclears and a few eosinophiles can be seen. There are some infolding areas of epithelium. No evidence of malignancy. Smears from lesion were positive for granuloma bodies. No cultures were taken. Blood count, hæmoglobin, 69 per cent; red blood cells, 2,100,000; white blood cells, 9,600; polymorphonuclears, 85 per cent; lymphocytes, 10 per cent; large mononuclears, 4 per cent; eosinophiles, 1 per cent.

Treatment. From February 10 to March 7 local treatment with the usual surgical dressings and applications produced no result whatsoever. On March 7, 1921, she was given 0.05 gram of tartar emetic intravenously, and noticed intense burning pain in the lesion immediately after administration, lasting about 10 minutes. On March 9, this dose was repeated and on the 11th and 13th 0.06 gram was given. After this fourth dose, evidences of healing appeared about the edges of the granuloma over the symphysis. Gram 0.06 was given on March 18, 21, 23, 25, 28 and 30, at which time it was seen that the condition, at first slowly healing, was now healing with great speed and rapidly being covered with epithelium. Same dosage was administered on April 2, 4, and 8 when her hæmoglobin was found to be 70 per cent and red blood cells, 3,000,000. Healing still progressed rapidly, and after injection of the same dosage on April 11, 15 and 18, the entire lesion was healed except for a small area to the

right of the anus and a heavy subcutaneous induration of the labia. Patient discharged. To continue treatment in Out Patients Department.

CASE 11. G. W., male, negro, age 25, admitted July 13, 1921, complaining of open sore in the right inguinal region. He had a chancre 4 years ago and gonorrhœa 3 years ago. This present condition was preceded by a bubo which broke down spontaneously and then healed. Upon the scar a new lesion appeared which has persisted for three years. Patient in wretched condition and health. Abdominal wall and thighs studded with keloids, scars and abscesses from the use of hypodermic injections. In the right inguinal region is a raw granulating surface typical of the granuloma lesion and 10 by 4 centimeters in extent.

Laboratory notes. July 18, 1921, smears from lesion, positive for granuloma bodies. Cultures, negative for Friedlaender-like bacillus.

Treatment. Tartar emetic was given intravenously as follows: 0.05 gram, July 15, 1921; 0.06 gram, July 17; 0.07 gram July 19; 0.08 gram July 21; 0.09 gram July 23, and on July 25, 27, 29, and 31, 0.10 gram.

Final note. The granuloma is very much improved and is healing along upper edges. Patient insists on being discharged against our wishes. He is a drug addict.

CASE 12. E. P., male, age 32, admitted May 5, 1921, complaining of sores on penis of 4 years duration following a slight "hair-cut" in the skin of the frenum. This slowly became sore and inflamed, and at the end of 1 year presented two sores each about the size of a finger-nail. Was given, a year ago, about twelve injections of neoarsphenamine with slight improvement but not complete healing, and during the past 2 months the lesion has shown greater activity and growth.

On examination the foreskin was found swollen, œdematous, and almost covering the glans. On the glans about the meatus and on the mucosa of foreskin on either side from frenum are sharply defined, firm, raw, red, oozing areas with slightly elevated borders. Wassermann reported 2+ and patient given three injections of neoarsphenamine, after which sore reported "drier, no oozing and cleaner, but no closing in of the edges, no islands of skin formation, i. e. no healing."

Laboratory notes. Smear from lesion—positive for granuloma bodies. Culture, negative for Friedlaender-like bacillus. Blood culture, sterile. Blood Wassermann, 2+; cholesterin, 4+; noguchi, 1+. May 7, 1921, smears from lesion, positive for granuloma bodies; cultures, negative for Friedlaender-like bacillus. May 9, 1921, complement fixation using antigens made from organisms from Case 16, Case 14, and Friedlaender-like bacillus from sputum. Results—all negative. Smears from lesion—positive for granuloma bodies. Cultures negative for Friedlander-like bacillus. May 14, 1921, inoculation of patient. Two abraded areas were made on the left arm; one was inoculated with cotton swab saturated with a 24-hour culture of the Friedlaender-like bacillus isolated from Case 16; the other with normal salt as a control. Patient was kept off of specific antimony treatment until May 31, 1921. Observations were last made on June 29, 1921, and up until this time no lesion had resulted. May 26, 1921, smears from lesion, negative for granuloma bodies; culture, negative for Friedlaender-like bacillus.

Histopathology. Section from granulations taken May 6, 1921. Fixed and stained as described. Picture that of original description. Very little proliferation of epithelium from skin. A few intracellular coccoid forms suggest granuloma organisms, minus their capsules. They are seen only in the large mononuclear cells.

Treatment. May 31, 1921, first injection of sodium antimony thioglycollate intravenously — 0.05 gram intravenously; on June 2, 1921, 0.06 gram; on June 6, 1921, 0.07 gram; on June 10, 1921, 0.10 gram; on June 13 and 16, 1921, 0.10 gram; on June 24, 1921, the lesion is healed. One area is covered with superficial scab. On June 24 and 27, 1921, 0.10 gram of tartar emetic was given intravenously. July 1, 1921, lesion is entirely healed. Discharged from ward. To continue weekly injection of tartar emetic in venereal dispensary.

Fig. 21. Case 15. Picture taken January 28, 1921. Duration 6 weeks. Wassermann 4+. Given neoarsphenamine and X-ray exposures for 5 months with only partial healing. Cured with five injections of tartar emetic.

CASE 13. D. H., female, admitted May 30, 1921, complaining of genital sores of one year duration, whose onset followed several boils upon the buttocks and started as an itching papule upon the labia majora and spread as a raw, oozing, red surface.

Examination reveals the labia majora as big, hypertrophied, swollen-looking affairs. Beginning with the inner margins, the labia are ulcerated, the ulcerated proliferating mass of tissue taking in both labia majora and minora on both sides and extending from the anterior part of the labia minora to the posterior parts in both sides. This mass is very hard, granular looking, with here and there a white plaque-like looking area. It is red but not bleeding. When touched or rubbed it does not bleed and very little pain is complained of. There is no odor. The mass extends to the entrance of the vagina, and here ends quite abruptly. The vaginal wall is not inflamed but feels quite hard. The cervix is not eroded and the cervical canal is normal. There is very slight discharge. No masses can be felt by vaginal examination. The uterus seems to be slightly posterior. There is no cystocele, rectocele, or vaginal fistulæ.

Laboratory notes. June 1, 1921, a section taken from margin of lesion, fixed, and stained as described, shows typical histological picture of granuloma but no intracellular organisms were found. June 3, 1921, smears from lesion positive for granuloma bacillus. Cultures, negative for Friedlaender-like bacillus. June 13, 1921, smears from lesion positive for granuloma bodies. Cultures, negative for Friedlaender-like bacillus. Some material directly from the lesion put into broth, centrifuged, and the sediment inoculated into animals. Three guinea pigs and a mouse were inoculated subcutaneously. No lesions occurred in any of the animals.

Treatment. Between May 20, 1921, and June 23, 1921, patient was given six (6) intravenous injections of 0.05

Fig. 22. Case 16. Picture taken on admission to Penitentiary, June 29, 1920. Lesion of 10 years' duration. Condition approximately the same when tartar emetic treatment started May 5, 1921. Healed in 45 days after 20 injections of tartar emetic.

gram each of tartar emetic. Between June 25 and July 26 patient was given four (4) injections of 0.08 gram each and three (3) injections of 0.10 gram each of tartar emetic. Between August 1 and August 22 (day of discharge), patient was given seven (7) injections of 0.08 gram each of tartar emetic.

On date of discharge, August 22, condition so thoroughly healed, that she was discharged to Out Patient Department to continue after-treatment. She has been working around the ward for the past month, has no complaint, and has gained in weight.

Case 14. F. D., male, *white*, age 25, admitted December 20, 1920, with excoriated sores about left groin and perineal region. Onset 2 months before with four or five sores on the penis. These primary lesions were soft, painful, and like fever blisters and were followed by an inguinal adenitis which became "ripe" and a doctor opened the abscess. It slowly but completely healed, but shortly after healing multiple sores broke out about the edges of the inguinal scar. These sores have received abundant attention and many local applications but have progressively spread until on admission the lesion extends down the side of the scrotum and thigh, over the perineum, and as far back as the anus and cheeks of the buttocks. Wassermann negative with three antigens; von Pirquet skin test for tuberculosis negative. There was great divergence of opinion among the staff as regards the diagnosis in this, the only white man in whom the granuloma bodies were found. First considered chancroidal, he was given local treatment; next as tuberculosis, X-ray was tried; in April the finding of typical intracellular organisms of granuloma inguinale started him on tartar emetic therapy and when no improvement was noted after eight injections, it was ordered off and a fourth opinion instituted active antisyphilitic treatment which was pushed for 2 months without any apparent improvement. Beginning July 26, 1921, patient has been getting on alternate days intravenous injection of 1 per cent tartar emetic. Started with 5 cubic centimeters and advanced to 10 cubic centimeters then dropped to 6 cubic centimeters per dose. Condition fluctuates. Heals almost and then breaks down anew. Now healed more than ever before and only a periphery of superficial and not particularly inflamed ulcerations left. Patient's general condition excellent.

Note.—This is the only case that we have experienced of infection in the white race. The picture was not typical and our feeling is that a double infection was probably present. He received vigorous antiluetic treatment to no avail in the face of repeatedly negative blood tests. His improvement under antimony has been more marked and permanent than anything during the previous 7 months. Picture shows the amount of improvement, patient at this date under continued antimony treatment. General physical condition has improved very markedly.

Case 15. B. B., female, age 20, admitted December 29, 1920, complaining of sores on genitalia and in groins. Onset 6 weeks before admission, as small papule on right labia. Patient picked this sore and one week later it started to increase in size and has refused to heal. Lesion found to involve left inguinal region, both labia, the right being ulcerated its entire length as likewise the right labia minora with extensions to entrance to vagina. Wassermann 4+ on all three antigens. Patient given two injections of neoarsphenamine and discharged to Out Patients Department where treatment with neoarsphenamine was continued at weekly intervals until June 1, 1921. She likewise received X-ray exposures at 3-week intervals. Readmitted on above date and local condition found somewhat improved, the labia of elephantic size and the lower half of right labium still an open sore.

Laboratory notes. June 3, 1921, smears from lesion, negative for granuloma bodies; cultures, negative for Friedlaender-like bacillus. June 6, 1921, smears from lesion, positive for granuloma bodies; cultures, negative for Friedlander-like bacillus.

Treatment. July 14, 1921, patient has received one (1) injection of 0.05 gram of tartar emetic and four (4) injections of 0.08 gram tartar emetic. Lesion is now entirely healed. Most of the induration has gone and patient is today discharged to Out Patients Department for continuation of treatment.

Case 16. C. B., male, age 43. Patient's first admission was in 1911, suffering with a sore involving foreskin and glans. Eight years before (1903) he had had a similar lesion which healed in 4 weeks and again 3 years before (1908) a second lesion on foreskin at which time he was circumcised and it took 10 months to heal. Present sore developed 1 year after the above second lesion and has had various

treatments during 2 years without any apparent effect toward healing. He remained in the hospital for 1 month and was discharged (on request) unhealed. Readmitted in 1915 with lesion showing destruction of skin and subcuticular tissues over entire penis and extending over upper portions of scrotum, into groins and suprapubically. Received active antiluetic treatment and 8 X-ray exposures. Diagnosed tuberculosis cutis and discharged 7 months later still unhealed. Readmitted in 1916. Penis almost completely destroyed and scrotum markedly swollen. Condition has gradually and continually grown worse. Similar diagnosis and treatment instituted and discharged 3½ months later, with condition somewhat relieved. Readmitted in 1917. Penis completely destroyed. Ulceration extending over right inguinal region and upper portions of scrotum. Received 18 X-ray exposures and discharged 10 months later.

NOTE.—Patient known to be at present an inmate of the penitentiary which he entered on June 29, 1920. Investigation found him to be in about the same condition as at the time of his fourth hospital admission as revealed in the picture taken at the time of his confinement. July 20, 1920, Wassermann test, negative. August 20, 1921, following letter received from Dr. H. Phillips, resident physician, Eastern Penitentiary, Philadelphia, Pennsylvania: "In accordance with your request we submit below data on C. B., a prisoner now confined in the above institution. On May 5, 1921, we commenced intravenous treatment. Injection 5 cubic centimeters, 1 per cent tartar emetic, gradually increasing dose until 10 cubic centimeters was given in each injection. These injections were given every other day for a period of 2 months. After 2 months the treatment was cut down to one injection weekly. After ten treatments were administered he began to heal very rapidly, and was entirely healed after being under treatment for a month and a half. Following is list of treatments as given: May 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31; June 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30; July 2, 4, 7, 14, 21, 28; August 4, last injection. Trusting this will cover the information desired."

Laboratory notes. April 26, 1921, smear from lesion—positive for granuloma bodies; cultures, positive for Friedlaender-like bacillus.

Histopathology. Section from margin of granuloma, fixed and stained as others. Structure typical of granuloma. Large preponderance of endothelial cells. Considerable proliferation of squamous epithelium. Coccoid forms seen in some large mononuclear cells.

HYDATID CYSTS OF THE PANCREAS[1]

BY MANUEL ALBO, M.D., F.A.C.S., MONTEVIDEO, URUGUAY

On connait peu les maladies du pancreas on ne les recherche pas. (*Arnozan.*)

HYDATID disease of the pancreas is a rare affection. Meisser in 983 cases found none of the pancreas. Feichman, among 2,452 cases found only 3, two of which were taken from the English literature and one from the Russian, making an incidence of only 0.12 per cent. Herrera y Vegas and Cramwell, in 970 cases from 1875 to 1900 mention none of pancreatic localization. Graglietto gives an incidence of 0.12 per 100 as compared with 42 per 100 in the liver.

In 375 cases from the statistics of the hospitals of Montevideo from 1908 to 1912 there were no cases of pancreatic involvement.

Pena gives the following statistics in 150 cases operated upon in the Children's Clinic

LOCATION OF HYDATID CYSTS IN ADULTS
1908 to 1912

	1908	1909	1910	1911	1912
Liver	36	47	43	72	54
Lung	7	14	17	19	11
Kidney	1	4	....	....	11
Mesentery	1	....	....	....	4
Ovary	1	....	....	1	....
Iliac fossa	....	2	....	....	....
Multiple of peritoneum	....	1	7	6	3
Lesser peritoneal cavity	....	1	....	....	....
Omentum	....	1	....	....	....
Pelvis	....	1	....	....	....
Muscular	....	1	2	3	2
Retrovesical	....	....	2	....	....
Submaxillary gland	....	....	1	....	....
Thyroid gland	....	....	1	....	....
Orbit	....	....	1	....	1
Liver and kidney	....	....	....	....	1
Spleen	....	....	....	....	3
Tongue	....	....	....	....	1
Cystic degeneration of the spleen	....	....	....	....	1
Vesico-uterine pouch	....	....	....	....	1

STATISTICS OF THE PREYRA-RUSSELL HOSPITAL
1908 to 1913

Age	3	4	5	6	7	8	9	10	11	12	13	14	
Location:													
Liver, only	2	4	1	4	17	3	7	9	11	10	6	1	75
Liver and peritoneal cavity	....	....	....	....	....	....	....	....	....	....	....	....	3
Liver and omentum	....	....	....	2	....	1	....	....	1	3	....	....	2
Liver and right lung	....	....	....	....	....	....	....	....	....	....	....	....	2
Liver and spleen	....	....	1	....	....	....	....	....	....	....	....	....	1
Lung	....	....	....	2	2	1	2	1	3	1	2	3	17
Peritoneal cavity	....	....	....	2	....	....	....	....	1	2	1	1	7
Brain	....	....	....	1	1	....	1	1	....	1	1	....	6
Neck	....	....	....	....	....	....	1	1	1	....	....	....	3
Total	2	4	2	11	20	5	11	12	17	17	10	5	116

[1] Translation through the kindness of W. R. Meeker, M.D., Rochester, Minnesota.

from 1896 to 1913, 125 of which were operated upon by himself.

Cysts of the liver	100
Cysts of the lung	10
Retrovesical cysts	3
Cysts of the kidney	3
Cysts of the cerebrum	2
Cysts of the spleen	2
Cysts of the neck	2

ETIOLOGY AND PATHOLOGY

Hydatidosis is an affection caused by the tænia echinococcus.[1] The affection is prevalent in countries in which man lives in contact with the dog; Iceland may be mentioned particularly. It also is prevalent in grazing countries and the number of cases seems to increase the longer the cattle raising industry is established. It is thus an important affection in many sections of South America. Cramwell and Herrera Vegas say: "Hydatid cysts were unknown among us until 1870 and it is only from 1890 that they began to be observed with certain frequence, but in the last 10 years they have increased in such an alarming manner that the government has been forced to consider means of combating the disease. . ."

DESCRIPTION

The head of the tænia echinococcus measures no more than one-third of a millimeter in breadth, is provided with four suckers and a projecting rostellum in which are inserted hooklets of variable dimensions and number. Generally 28 to 50 may be counted. The neck is very short and the body consists of three or four segments at the most, the last segment measuring near 2 millimeters in length and 0.5 millimeters in breadth. The total length is 2.5 to 5 millimeters, being one of the smallest species known.

LARVA

The larvæ are the hydatids or echinococcus (echinococcus polymorphus). They develop in a great number of herbivora particularly in the sheep, and less often in carnivora, in the liver, lungs, and different organs. They are frequently observed in man in which they produce what is called hydatid cysts. The cyst is formed by the tissues of the host surrounding the hydatid in a parasitic manner.

[1] Tænia Echinococcus—Siebold, 1853. (Type, vermes; class, plathelmints; order, cestodes: family — tænia; group, tænia vesicula or cystica of Leukart.)

EVOLUTION

The ovum measures 30 to 36μ in diameter and contains a dormant embryo. Ingested by a sheep or man it changes to a vesicle (hydatid) with a wall composed of an external laminated cuticle and an internal germinative or parenchymatous layer. This membrane gives rise to brood capsules, from which scolices are developed. A single ovum may thus give rise to hundreds of adult worms.

The scolices retained by a fragile peduncle may become detached, but are more often invaginated. They frequently disinvaginate and the hooklets return to the exterior. As they perish they fall into the liquid of the broad capsule. The wall of a cyst may become thin and rupture, thus discharging heads or hooklets of tænia echinococcus free in the cystic liquid. These may be detected by microscopic examination after puncture of a cyst.

When a part of the germinative membrane is surrounded by a cuticular lamina, small vesicles are formed which travel toward the exterior as the result of continuous formation of an internal stratum of cuticle. These daughter cysts have the same development as the original and according as they fall by rupture of the cuticular membrane into the mother cyst or outside of it, there may arise endogenous or exogenous daughter cysts.

In all the cases the endogenous daughter cysts differ from the parenchymatous cysts in that the first presents always a stratified cuticle while the endogenous present none at all. Daughter cysts may in turn produce grand-daughter cysts. In certain cases there may be arrest of development of hydatids, the cyst continuing to grow in size, but there are no corresponding production of heads. This produces an acephalic cyst. The hydatid liquid is very toxic.

The third segment has a perfectly developed reproductive apparatus and contains in its interior no less than 500 ova (*Parasitologie humaine*, Neveu-Lemaire).

When the ova are eliminated to the exterior they may be distributed by wind or water and

deposited upon vegetables which are eaten by animals and man. They may remain in water which is used for drinking purposes and thus may be consumed directly.

The ova may also be directly transmitted in other ways. The intimacy of men and dogs in many localities is well known, as for example in Uruguay. Here the dog forms an integral part of the family, living in the same habitations, eating from the same plates, constituting for the rustic herdsman his most faithful friend and in the end really his most terrible enemy. The herdsman feeds the dog with the same fork with which he himself eats, often sharing mouthfuls equally. It is clear then that the dog may infect the man directly, if we bear in mind that numerous ova of tænia echinococcus remain adherent to the hairs of the anal region after defæcation and that the dog licks this region frequently in his habits of cleanliness.

The ova once introduced into the digestive apparatus reach the stomach and are mixed with the gastric juice. This dissolves the investing membrane in 4 or 5 hours, according to Leukart, who fed ova to rabbits. The embryo itself is in consequence liberated and mixed with the stomach contents. It is then carried to the duodenum where it makes use of the hooklets with which it is provided, attaching itself to the intestinal mucosa and finally opening up a passage for itself through the intestinal coats. From here it may localize in different regions of the body, preferably in the liver.

What is the route which the embryo follows in this last passage before implanting itself definitely in the organs of the body? In the majority of cases the liberated embryo after having passed through the intestinal walls penetrates to the capillaries and is carried by the portal circulation to the liver where it anchors and gives rise to the most common of hydatid cysts. Leukart's observations have proved many times the existence of embryos in the blood of the portal vein of rabbits infected with ova of tænia echinococcus.

The mode of transmission may also be the portocaval system or by way of the hæmorrhoidal veins which according to some authors is the most frequent.

This manner of infection is certainly the most common and explains why the cysts localize preferably in the liver.

Some authorities are supporters of a direct migration and maintain that the embryos of the intestinal walls pass, by means of the lacteals, to the lymphatic channels and thoracic duct. They are thus emptied into the venous system, making their way to the right heart, pulmonary artery and lung, either anchoring here or being disseminated to other organs. "This manner of infection must, however, not be very frequent as it would not explain why hydatid cysts are so much more common in the liver than in the lung." (P. Belou.)

Contagion by inhalation of dust particles in which dessicated ova of tænia echinococcus may be present is cited by certain Australian physicians (Bird). By this means ova might lodge in the lung and be disseminated from here by vascular embolism. We think this method may be disregarded except for the possibility of contaminating the digestive tract by aspiration of respiratory secretions.

The digestive tract must be admitted the most frequent route of entrance with intermediary of the blood stream for localization in the pancreas. It may be supposed that, because of the anatomic characteristics of the gland having its excretory ducts in connection with the duodenum, there might be a direct migration from the duodenum This method has been supported by Hauser who regards the contamination of the portal system as the less rational method.

With regard to this hypothesis of Hauser we may repeat Devé's assertions concerning the migration of the liberated embryo from the intestinal tract to the liver. He maintains that the passage can be directly across the peritoneum or indirectly at the expense of subperitoneal tissue, but that the most probable hypothesis is that the portal vein constitutes the great avenue of entrance of the hydatid parasite to the liver and in a general way to the entire organism.

Exceptionally, he says that a certain quantity of embryos may be carried to the liver by the arterial route, as for example by the cœliac trunk in the case of an echinococcus

septicæmia following the massive infection of the blood stream by rupture of a cyst. Although the development of the liberated embryo has not been studied experimentally for the pancreas we must deduce from the probable origin that it would not be in the interior of the glandular acini, but in the periacinar vascular network in which the parasite would most likely be detained. During its progressive growth the encasing cuticle is developed as the result of a local reaction in which the surrounding vascular tissue and migratory elements participate, the parenchymatous cells disappearing entirely as the result of toxic necrosis and mechanical pressure in the region of the parasite (Devé, loc. cit.). The permeability of the glandular duct is, however, conserved as the duct epithelium persists in spite of compression. This would indicate that glandular function would be restored with removal of the parasitic process.

In which direction do cysts of the pancreas usually develop? In the direction in which they encounter least resistance, and in this way the cyst may project into the lesser omentum, below the transverse mesocolon, or into the gastrocolic ligament. Attention must be called to the fact that the direction of greatest growth of the cyst does not indicate a superficial location in the pancreatic parenchyma at that point, as the gland itself may be pushed forward by the growing cyst.

PATHOLOGICAL ANATOMY

The development of the parasite within the gland provokes reaction in the surrounding tissue resulting in the formation of a fibrous envelop usually of finer texture than that which develops in the lung and liver. There are, according to Chutro, no signs of sclerosis or congestion of glandular tissue to microscopic examination. Even though such changes might be produced they are certainly not marked, so that no deficit of glandular function is felt except in those cases in which there is compression of the ducts. On the other hand, when the tumor is implanted in the gland in a superficial position, its position becomes subserous and the vascularity of the omenta and mesenteries is increased often to an extent that would make its extirpation seem dangerous to most surgeons. There is often retraction of the lesser omentum and adhesions to the stomach, colon, and liver. Adhesions to the abdominal wall are found only in the last stages of development.

Cysts developing in the cervicocorporeal portion of the pancreas usually have one of three points of prominence: (1) across the lesser omentum, (2) across the gastrocolic ligament, (3) across the transverse mesocolon.

Cysts, developing in the tail of the pancreas, usually force forward the stomach and sometimes the transverse colon and often appear at first sight to be below the kidney.

The hydatid cyst continues growing until evident tumefaction is produced in most cases. In other cases the phenomena of canalicular compression (Wirsung and Santorini) play a more important part. These trains of symptoms are largely dependent upon the position. Hydatids situated in the head of the pancreas and in front of the ducts cause compression very late, while those located within the ducts or behind the duct of Wirsung produce phenomena of compression very early.

COMPLICATIONS

Suppuration has been shown in some observations. Biliary and pancreatic retention with the resulting complex of symptoms may be admitted as the rule with certain cysts. Spontaneous rupture has not been observed. There have been no cases of rupture into the digestive tract reported in the literature.

SYMPTOMATOLOGY

We divide hydatid cysts of the pancreas into three groups according to the pathological anatomy, as follows:

1. Those which develop in a latent or almost latent manner so that they give a symptomatology of palpable or appreciable tumor;

2. Those which develop rapidly producing symptoms resembling those of cancer of the bile ducts or head of the pancreas;

3. Those that produce symptoms resembling those of retroperitoneal tumors.

Those developing in a latent manner with symptomatology of palpable tumor usually produce the same symptom as those of blood cysts of the pancreas. There may be light pains in the epigastrium from irritation of the cœliac plexus, due to the size of the tumor rather than the cystic formation *per se*. The oppression in the epigastrium may at times be of a spasmodic form due to the same cause. There may be accompanying inaptitude, nausea, and vomiting. Intestinal symptoms may be constipation from compression of the colon, a viscid diarrhœa called "flux," a greasy diarrhœa signifying pancreatic insufficiency which would be in relation to the extent of glandular destruction. Pancreatic salivation is exceedingly rare (Ludolph and Zielstorff), but it should be kept in mind. The slow pulse would seem to be dependent upon a vagal stimulation. Cachexia is far from frequent (functional deficit) the same as the diabetic syndrome. There is often a transmitted pulse.

We were not acquainted with Navarro's sign (dimunition in the number of pulsations by compression of the pancreatic area) when these patients came under observation so that we did not look for it. The phenomena of compression of the duodenal arc may produce the syndrome of chronic obstruction in this organ with its symptom-complex (vomiting, malnutrition), and it is possible that it may have passed unappreciated in the greater part of the cases operated upon, this syndrome being attributed to mechanical reflexes. The tumor is often perceptible to inspection appearing in the epigastrium when located in the head, in the same region or nearer the umbilicus when located in the body, and in the hypochondrium and flank when located in the tail. The point of greatest prominence is variable, but these tumors follow in general the scheme of Kortê and Mayo-Robson already mentioned under pathological anatomy.

Cysts of the head of the pancreas, simulating a cancer of the bile ducts or head of the pancreas, give the following symptoms: (1) general emaciation; (2) bronze color of the skin; (3) icterus most always persistent and progressive with a dilated gall bladder (Courvoisier-Terrier law), with the accompanying discoloration of the fæces, and icteric tinted skin, mucosæ, and urine; (4) pain in the pancreatic area; (5) aversion to fats and oils; (6) pain radiated to the back and left lumbar region; (7) tumefaction, not always palpable even in cachectic subjects (as in one of our cases).

Cysts which develop as retroperitoneal tumors are usually without symptoms except the pain and marked tumefaction when it exists, features which have caused confusion with tumors of the kidney and adrenal.

DIAGNOSIS

Is tumor present? If the answer is affirmative, is it of the pancreas? The question is settled in the following manner.

Determine first whether the tumor is parietal or intra-abdominal. Augagneur has stated that in dealing with an abdominal tumor the first step should be the elimination of tumors of the abdominal wall. Palpation is usually sufficient to do this. A number of diagnostic procedures, however, enable one to decide this point with certainty. If the tumor is mobile or relatively so but becomes fixed when the patient contracts the abdominal muscles, it indicates that the tumor is of the abdominal wall (elevation of the head).

Tillaux preferred the following procedure. The most prominent point of the tumor is marked with a dermographic pencil, and the patient is instructed to inhale and exhale using force in the procedure. If the tumor is of the abdominal wall the most prominent part of the tumor and the skin marking remain in the same relation to each other; on the other hand if the tumor is intra-abdominal, the relations change.

To determine whether the tumor is intraperitoneal or retroperitoneal the same author reasons as follows: Intraperitoneal tumors usually displace the intestinal loops coming in contact with the abdominal wall. The retroperitoneal ones are usually covered by loops of intestine, stomach or colon, so that resonance in front of the tumor will be pathognomonic of retroperitoneal tumors and vice versa, according to Spencer-Wells. Then it has been established that the tumor is retroperitoneal, it remains to determine whether

the tumor developed from the kidney, the mesentery, or the pancreas. If from the mesentery, as a rule it has a median location, umbilical, with intestinal loops in front and immobile laterally. If from the kidney, the location will not be median but lateral and covered by colon; it usually gives increased lumbar dullness and is immobile transversely. If from the pancreas, its location will be median except when located in the tail. It is almost, but not entirely immobile. Le Dentú has assigned great value to a hydro-aerial sound perceived in front of the tumor, really a sign of little value if we remember the possibility of spontaneous hydropneumatic cysts, or those arising from communication with a hollow viscus. More value should be accorded the method of Minkowsky and Nauyn, which consists of the following: (1) accurate determination of the site of the tumor; (2) gaseous distention of the stomach with citric acid and sodium bicarbonate, with a new observation of the tumor which should have been displaced downward; (3) the gas is next released from the stomach by means of a Faucher's sound; (4) an intestinal enema of 2 liters of water is given, noting the new displacement of the tumor somewhat upward.

If, as Chutro believes, it is possible to diagnose hydatid disease of the pancreas, we must admit that the diagnosis without doubt carries a high percentage of error in view of the rarity of the affection. There is neither an eosinophilia nor deviation of complement (Bordet, Geangou, Wassermann reaction), as constant findings to aid in the diagnosis. The résumé of cases to date with the exception of those of Chutro shows that diagnosis has not been made except at operation or autopsy. The symptoms cited by Chutro are not peculiar to this affection but are common to any tumor of the head of the pancreas. We give herewith the basis of diagnosis formulated by this author:

1. Spontaneous pain in the abdomen near the umbilicus and a sense of pressure following a transverse direction in the epigastrium and extending to the hypochondrium;

2. Gastric disturbances of reflex origin from compression without any organic lesion to account for the symptoms;

3. Obstructive icterus which is not modified during a year by medical management;

4. An enlarged gall bladder, which would indicate a tumor at the head of the pancreas (Courvoisier and Terrier).

5. Aversion for fats, and above all the elimination of all fatty substances, without having undergone any digestive changes;

6. Rapid and pronounced emaciation with great loss of strength;

7. The finding of a deeply situated tumor behind the stomach, globular and smooth, and in the region of the head of the pancreas;

8. Completely benign character and gradual development;

9. History of individual residing or having recently come from a country in which echinococcus disease is common;

10. The fact that cysts of the inferior surface of the liver often give signs of compression of the bile ducts, but rarely of the duct of Wirsung;

11. No deformity of liver.

The diagnosis is thus arrived at by a process of exclusion. In case of doubt prolonged icterus is sufficient cause for surgical intervention.

Differential diagnosis should include cysts of the lower surface of the liver and tumors of the spleen and kidney distinguishing features of which have already been mentioned. Important points are the relation to respiratory movements and location with respect to the stomach and colon. Radiography is also important in diagnosis, a previous pneumoperitoneum often permitting identification of the pancreas.

TREATMENT

No satisfactory antiparasitic drug is known. "606" and "914" which have been recommended by some authorities seem to possess no particular value.

In operating, the incision should be so made that it will give the easiest delivery of the tumor; median or lateral according to the particular case. The Bevan incision applied to the left side as proposed by Mayo and Balfour for extirpation of the spleen would be indicated in a cyst of the tail of the pancreas. Recognition of the tumor is not always easy. In our case, in which the greater amount of glandular parenchyma was in front of the cyst, the

impression from palpating the tumor was that of a growth situated at the head of the pancreas. The site of implantation is not always easy to discover when the tumor projects markedly across the lesser or greater omentum or the transverse mesocolon. It is stated that many hydatid cysts of the pancreas are not recognized as such, and that they are merely conceded reactions due to proximity to the pancreas (bordering the gastrocolic omentum, spleen, and so forth). On the basis of location it is convenient to divide them into intraparenchymatous and subserous cysts with sessile implantation. Removal of the tail of the pancreas through the gastrocolic omentum (Lardenois and Okincick) may have its indications. Mobilization of the head of the pancreas (Wiart Sencertt) is suitable for all cysts of the head which permit their delivery, such as those which are situated on the posterior portion of the pancreas and those projecting anteriorly. An ample protection of the peritoneum must be afforded in view of a possible dissemination of hydatids.

Extirpation of the tumor is usually not advisable. This was tried in Graglietto's case, but it is not certain whether this tumor was of true pancreatic implantation. It was a case of pedunculated hydatid whose origin was not certainly pancreatic. With cysts of true glandular implantation extirpations have been practiced only on a part of the pericystic tissue.

Evacuating puncture with the appropriate trocar (Potain trocar for small cysts, and the ordinary ovarian cyst trocar for those of great volume) should be followed by the injection of parasiticidal liquid. We employ a solution of pure formaldehyde 2 per cent in water, or the injection of pure formaldehyde with a Pravast needle and syringe in a quantity proportional to the volume of the cyst. After the proligerous membrane and daughter cysts have been removed, one should proceed to dry the cavity with gauzes soaked in ether, containing some antiseptic substance after the method of Devé. Should the cavity be closed, or drainage practiced? In our experience, it is best to close the cysts if the content is clear, unless the cyst is very large or in case it is necessary to resect the pericystic tissue followed by hæmostatic closure.

To prevent a possible hydatid intoxication, which happens more frequently than most authors will admit, we inject 1 cubic centimeter of 1:1000 synthetic adrenalin (Parke Davis and Co.) during operation also during the following days if tachycardia and dyspnœa accompanied by oliguria persist. The action of this drug in the prevention shock has been well demonstrated in other abdominal operations. Professor Delbet first recommended its use many years ago.

If marsupialization of the pericystic pouch is done it is an easy matter to drain by aspiration as would be done in pleural empyema. Discontinuous instillation of Carrel's fluid should be employed if the microbic conditions of the infection indicate it.

As complementary operations cholecystostomy may be indicated when icterus is very pronounced and there are indications for rapid drainage of bile. There may be indications for gastro-enterostomy in cases of duodenal compression.

The feature in which medical men should become especially interested is that of prophylaxis. This is especially difficult to practice in country districts where there is usually mediocre intelligence and general disregard of advice along scientific lines.

A decrease in the number of dogs on the ranches is of aid. The periodic administration of vermifuges such as calomel and kawakawa to the dogs produces a condition of lowered contagion. The incineration of the carcasses of sheep in which cysts are found, keeping dogs and hogs away from them should be practiced and especial care should be exercised in order that the water supply does not become contaminated. Thorough cooking of all greens which may possibly be infected is recommended. The exclusion of dogs from the living quarters of the family would greatly reduce the incidence of the disease, especially in children.

CASES FROM THE LITERATURE

Cases autopsied. The older cases are of but little importance and they are mentioned only in a general way without laying great stress upon their location and relations. Such cases as those cited

by Montaux and Portal seem to be cases of implantation external to the pancreas with which they were only in contact.

Masseron (thesis upon multiple cysts of the abdomen, Paris, 1881) cites three cases. Two were taken from Turner and Hunter and are of questionable location in contrast to one taken from Meissner which seemed to be an intraglandular cyst. Engel refers to an autopsy of a case of multiple hydatidosis, brain, kidney, and so forth, in which there was also a preglandular pancreatic cyst. The second case of Claessen was undoubtedly glandular and Seidel gives one of the tail of the pancreas.

Thomas. Statistics of cases of echinococcus observed during 10 years, 1868 to 1877, shows only two of hydatid cysts of the pancreas.

Nadashdin gives 0.3 per cent as the result of numerous statistics.

The protocol of Hauser upon the necropsy may be taken as a model of precision and is given herewith.

Carlos B., age 61, caretaker of sheep in Hunter B (North of Mecklenburg) died August 15, 1911. The patient entered the University Hospital, surgical service, April 27, 1911, complaining of urinary retention, cystitis and tumor (abscess?) of the prostate. The illness had begun with intermittent fever and had continued from a carbuncle of the back. The patient was transferred to the ophthalmological clinic on May 31, 1911, because of an iritis. While there the prostatic abscess must have perforated spontaneously. On June 15, 1911, after the iritis had cleared up, he was again transferred to the surgical section. While here a fluctuating abscess developed in the muscles of the left arm. A pneumonia became associated with this. A left pleural effusion was punctured twice showing a very septic and degenerating content. His general condition grew progressively worse finally ending in death on August 15, 1911. Interrelated with these symptoms were certain stomach complaints. An examination of the stomach contents after a test meal showed the following results on July 30, 1911: neutral reaction, no free hydrochloric acid, negative lactic acid, and no evidences of stagnation. There was no palpable epigastric tumor. Clinical diagnosis was as follows: septic pneumonia and bilateral pleuritis. Multiple disseminated abscesses. Prostatic abscess. Cystitis. Suspect cancer of the stomach. The autopsy essentially confirmed the clinical findings. No tumor of the stomach was found. Anatomic diagnosis was as follows: sepsis, septic tumor of the spleen, bilateral perinephritic abscesses, renal abscesses, cystitis, and prostatic abscess. A pleural empyema was found on the inferior part of the left side with extensive pleural adhesions. Hypostatic pneumonia on both sides. Echinococcus cyst of the tail of the pancreas. Staphylococcus pyogenes was cultivated from the blood and from the spleen. The following extracts from the protocol are related more particularly to the pancreatic cyst.

Upon opening the abdominal cavity a pronounced distention was noted. The veins of the greater omentum, and left gastro-epiploic vein were very prominent as from obstruction. These phenomena were found to be due to the presence of a deep tumor not visible *in situ* but evident to palpation. The lesser peritoneal cavity was entered by incising the gastrocolic omentum. From the posterior wall of this cavity the tumor was seen limited above by the stomach, below by the transverse colon on the left by the spleen and gastrosplenic omentum, and on the right by the duodenum and liver. The pancreas seemed to be divided, but in the tail, covered by peritoneum, was the tumor. While *in situ* it was plainly seen that the splenic vessels were intimately adherent to the tumor though not markedly distended. The tumor itself reached to the hilus of the spleen to which it adhered by a ligament (pancreatic-splenic). The specimen was freed from its coverings and the organs surrounding it was removed. The head and body of the pancreas showed no particular changes. The relations with the duodenum were the same as normal. The length of the gland including the cyst was 17 centimeters, a figure which corresponds to the average normal established by Henle and Sappey.

To external measurement the pancreatic tissue measured 11 centimeters and the remainder was tumor tissue. It is, therefore, easily established that the cyst was not adherent to a prolongation but that its location corresponded definitely to glandular substance. Confirming this opinion is the fact that the tumor adhered directly to pancreatic tissue and moreover that it occupied the space included between the visible termination of the pancreas and hilus of the spleen, that which is ordinarily the situation of the tail of the pancreas.

There was a progressive change from glandular tissue to tumor. The specimen demonstrates nicely the gradual thinning out of pancreatic tissue, which disappears without any precise limit on the surface of the tumor. The cyst itself is pear-shaped, measures 6 by 9 centimeters, and is adherent laterally and superiorly to the pancreas. The axis of the pancreas forms an angle of 120 degrees with that of the tumor. The cyst, therefore, faces downward and to the left. The tumor is smooth with the exception of a few small concretions of white color and flucutuating to pressure. Upon incision of the posterior wall a clear, watery liquid escaped in which two daughter cysts the size of cherries were recognized. Sections show clearly that the sac is filled with daughter cysts of variable sizes, in part freely floating, and in part adherent in the form of clusters. The thickness of the cyst wall varies from 1.5 to 2 millimeters.

The specimen was given to the Institute so that further pathological studies were not made.

In none of the other organs were hydatid cysts present. We are dealing in this case, therefore, with a solitary echinococcus unilocular cyst of the tail of the pancreas.

OPERATIVE CASES

Author's personal case. Sinforoso Barcia, an oriental, age 23, single, of Department Florida Villa Vieja, entered Maciel Hospital April 1, 1914.

Three years ago he began to suffer pain in the right side of the abdomen. The pain radiated to the shoulder, and was accompanied by gastric disturbances which began with a marked aversion to fats, later including certain other articles of diet, such as milk. He had never vomited. Constipation was present at this time and became more marked under a régime of soft diet. These disturbances continued for a year in which icterus appeared increasing progressively in intensity until the skin became an olive tint which persisted until the end. It persisted for 2 years in spite of medical treatment and consultation. There was a loss in weight of 20 to 30 kilos. Physical examination showed marked icterus of the skin, mucous membranes, and scleræ, with severe generalized pruritis, apathy, and bradycardia. There was no temperature. The liver was somewhat enlarged but not tender and did not show any tumefaction. The pancreaticobiliary zone of Desjardins was painful, but there was no appreciable tumefaction at this site. There was increased frequency, the urine being loaded with bile pigments. Fæces were entirely colorless. Urotropin, Vichy water and milk were given. Three days before operation he was given 2 grains of calcium chloride, purged with calomel, and lavage on each of the three days preceding operation.

Operation. Anæsthesia of pantopon and ether without incident. A Sprengel incision with abdominal exploration revealed a tumor in the upper abdomen and behind the stomach when the duodenum was lifted. The liver was a little enlarged, darkly discolored, with an enlarged gall bladder which, to palpation, appeared to contain foreign bodies. The greatest dilatation was in the central part where there was a fibrous appearing zone.

Appendectomy, aseptization of the stump with iodine and invagination.

To examine the tumor it was necessary to mobilize the doudenum. It was then possible to appreciate the fact that the tumor formed a part of the head of the pancreas. Puncture made across the parenchyma of the gland on the anterior aspect with a Pravast needle gave a clear watery liquid. Examining the posterior surface, a prominent part of the cyst was found in contact with the duodenum. The cyst was punctured with a Potain trocar and the cystic fluid evacuated. The sac was further opened and the proligerous membrane, which was about the size of an orange, extirpated. The cystic cavity and regional peritoneum was washed with ether. The fibrous capsule was sutured, cholecystostomy performed, and the abdominal incision closed with catgut and silk in two layers.

Postoperative. In spite of the employment of stimulating injections of physiological saline and camphorated oil the pulse as well as the general condition did not improve. As would be expected the gall-bladder drainage gave an abundance of bile. The temperature was 38°C. the pulse between 120 and 130 per minute, auscultation showed râles in both bases, and there was a cough and difficult expectoration. The scant urine in the first few days increased to a liter or more later on. Stitches were removed on the eighth day and the same night there was an evisceration of intestines through the wound as a consequence of the severe cough. The intestines were restored and the abdominal wall sutured in one plane with silver wire. Murphy drip was given, the patient placed in the Fowler position, and camphorated oil given. The temperature continued, high emaciation, and general condition became worse and the patient died on the eighteenth day after operation. Autopsy could not be obtained.

Case of Dr. Mondino (not reported).

Elcira Chodio de Robaina, age 30, native of Uruguay (Department of Maldonada) entered the sanitarium, January 29, 1920. Upon inspection a globular tumor, about the size of a big orange, was seen in the left flank. The tumor was deeply fluctuating to pressure. It was dull to percussion and the dullness was continuous with that of the liver. There was a distinct resonance between this organ and the spleen which did not follow respiratory movements. Hydatid fremitus was not present. The general condition of the patient was excellent, complaining only of a pain in the back radiated to the lumbar region.

Clinical diagnosis. Hydatid cyst of the spleen.

Operation. On January 30, a pararectus incision was made, reaching to the spleen. After incising the external ligaments and peritoneum and entering the abdominal cavity it was noticed that the tumor was in contact with the spleen but that it was not a part of this organ, being luxated somewhat toward the outside. It was thus seen that the tumor was within the lesser peritoneal cavity. On incising the lesser omentum, glandular tissue was encountered which was identified as pancreas. This was protected with compresses and the tumor punctured. Scarcely had the needle penetrated, some 5 millimeters, when hydatid liquid was obtained and the entire cyst was emptied by aspiration. The germinative membrane was incised and extracted, followed by a discharge of yellowish fluid which was collected for further examination. A section of the glandular tissue was also removed for examination. By digital palpation of the cavity, the cyst was recognized as one of the tail of the pancreas, and that its position was intraglandular. The cavity of the cyst was sutured and left in place.

On February 8, the patient was discharged completely recovered. A letter received 6 months later stated that a smaller tumor had recurred at the old site and later completely disappeared.

Dr. Pedro Chutro, surgeon of the Teodora Alvarez Hospital. Hydatid cyst of the pancreas.

Benjamin M., age 26, entered the surgical service of the San Roque Hospital May 24, 1906. The family history was unimportant. In infancy patient had measles and transient gastro-intestinal disturbances. No history of syphilis, malaria, tuberculosis, or alcoholism.

For a year he has enjoyed good health, but in this period and without known cause he began to be bothered with repeated vomiting accompanied by acid eructations which usually occurred a short time after meals. At the same time he had acute pains in the right hypochondrium irregularly intermittent and not radiating. He consulted a physician and in spite of the treatment prescribed he grew worse. He vomited bilious material of mornings and sometimes during the day.

At the end of a month he began to notice an icteric tint to the scleræ and discoloration of the fæces. He was treated as a case of catarrhal jaundice but in 15 days he was so debilitated he could not leave his bed. Icterus also increased in intensity, the skin becoming a dark olive color. The urine was almost green and the fæces the color of plaster and very hard. Pruritis was so intense he could not sleep.

For 4 months he traveled from one hospital to another having tried several varieties of medical treatment, with no results. He continued to lose rapidly in weight, and assimilation of food was almost nil. At this point is recounted a feature of great diagnostic importance.

He stated that he was ordered to take 100 grams of olive oil daily which he did for 3 months. At times the oil was eliminated in the fæces in the same condition as it was when ingested, without having undergone any transformation whatever. More frequently it was excreted in the form of globules of variable sizes as large as that of a nut, greenish yellow in color, of gelatinous consistency and breaking up under the least pressure allowing the oily content to escape. They resembled in all respects the capsules of castor oil now in current use.

After a long period in bed in dorsal decubitus posture his digestive troubles improved. His fæces became somewhat colored and the intensity of the icterus diminished, although it never entirely disappeared whether in bed or up and about. All symptoms recurred later and were accentuated. This led many diagnosticians to believe that the patient had a calculus, with a certain amount of mobility and lodged in the common bile duct.

The patient had also a degree of neurasthenia, and having tired of medical treatment insisted that he be operated upon at once. Temperature 37.2°C. Pulse regular, somewhat tense, and rather frequent, 98 per minute.

Patient was a young man, well developed, but emaciated and wasted. An icteric tint was very marked on the mucous membranes and skin, the latter showing erosions produced by scratching because of the intense pruritis. The left side of the thorax was normal. On the right side there was a moderate elevation in tone. Auscultation revealed the presence of a few râles at the bases. The hepaticopulmonary boundary came to the fourth rib and presented no irregularity. On the right side the inferior part of the thorax was more voluminous. The greater elevation of the costal margin and bulging of the intercostal spaces was clearly perceived.

The liver was 8 centimeters below the costal margin. It was uniformly enlarged conforming to the normal configuration of the liver. The margins were sharp, regular, and distinctly palpable. It was somewhat tender to pressure and followed the respiratory movements. In the incisura of the liver also in apposition with the inferior surface of the liver was a tumor the size of an orange, globular, smooth, somewhat movable, painless, and soft in consistency which together with the location was thought to be a distended gall bladder. To palpation it gave the sensation of a rubber ball, and it could be distinguished as independent of the right kidney the inferior pole of which it touched. To digital palpation of the right epigastrium, the impression of a tumor was obtained, the limits of which it was impossible to estimate because of the tension of the abdominal wall, but it did not appear larger than the size of a fist.

Superficial percussion gave resonance in all this region, but deep percussion demonstrated a zone of dullness in the center surrounded by a tympanitic zone. The dullness was located in the epigastrium, and was independent of the liver from which it was separated by a border of very clear resonance.

Under anæsthesia it was found that the tumor was entirely globular and about double the size of that which was evident to palpation before. It now seemed a little independent of the liver, was somewhat movable, but independent of respiratory movements. The spleen was a little enlarged.

The urine contained a great quantity of biliary pigment and vestiges of albumin and glucose.

Examination of the fæces showed that pancreatic juice had not entered the intestines and microscopically it may be said that the fats had not undergone any specific digestive action.

Diagnosis: On the basis of the above data we concluded that a tumor was present, which, from its evolution and character, should be a hydatid cyst compressing the ampulla of Vater and the location of which should be the head of the pancreas.

Operation. May 25, a short time before operation, patient was given an injection of a liter of physiological saline. Incision was made somewhat to the right of the linea alba reaching from the costal margin to the level of the umbilicus. Opening the abdomen the liver was seen to be congested, and greatly increased in size but not distorted in shape. Externally the gall bladder appeared normal although the fluid contained was under great tension, and the organ had dilated to a point four or five times the normal size. It evacuated its contents slowly by external pressure. Upon examina-

tion of the biliary passages attention was called to the retraction of the gastrohepatic omentum and the presence of a tumor behind the duodenum in the lesser omental cavity independent of the liver. A small puncture yielded clear watery liquid. The gall bladder was so greatly distended that it was a great obstacle to work in this region so that instead of making an evacuating puncture and then mobilizing the intestine to reach the tumor we preferred to approach it in another manner. We therefore temporarily abandoned the first incision and made a median supra-umbilical laparotomy incision. Behind the gastrohepatic omentum the tumor was recognized. It had developed in the head of the pancreas. It was incised with a bistoury letting escape more than a liter of hydatid fluid in which were countless daughter cysts. The membranes were extracted and the cyst cleaned as well as possible. As the cyst walls were very thin and impossible to bring to the border of the wound for marsupialization, drainage was performed by means of gauze and a glass tube packing the cavity to the bottom, passing between stomach and liver. The first laparotomy wound was closed in three layers. In the second a space for drainage had to be left open. Hypodermoclysis of a liter of saline was given. During night patient complained of great pain, but the following two days were passed uneventfully.

During the night of May 28 he had the first bowel movement of colored fæces thus demonstrating the patency of the pancreaticobiliary passages. He seemed markedly improved; upon removing gauze pack a quantity of daughter cysts were discharged. June 1 daughter cysts were being discharged daily. Fæces were well colored. The intense coloring of the skin was gradually disappearing. After having had no appetite for over a year the patient asked for food and was given meat and milk.

June 4, a slight icteric tint was just discernible in the scleræ, while on the skin it was still marked. The cyst continued reducing its capacity and day by day fewer daughter cysts were discharged. Marked improvement in assimilation of food and nutrition and the general condition was daily improving. All sutures were removed.

July 2, all traces of icterus had disappeared. Cysts had ceased discharging, and the drainage tract was growing smaller in size. At the end of October, the patient left the hospital entirely recovered. He had gained 14 kilos in weight.

In May, 1908, he returned for observation with a small eventration which is common in marsupializations. The scar was excised and the abdomen closed in three layers. Viscera in perfect condition.

Virgilio Gragietto. Echinococcus cyst of head of pancreas. Clinica Chirurgica, 1913, p. 786.

Antonia D., age 36, married, entered the surgical section July 31, 1911, with diagnosis of abdominal tumor. She had never been ill, menstruation had been regular until 2½ months ago when it ceased. She had had nine normal deliveries at term. During the past 3 months she had observed that the abdomen was increasing in size, and she could palpate the tumor through the abdominal wall. It did not cause her any pain or trouble of any sort. She was worried only by the progressive increase in size of the abdomen. The patient was a thin woman, poorly nourished, and very pallid. Temperature was normal, pulse full and rhythmic, rate 72 pulsations per minute. Cardiac borders were normal, tones were clear, and lungs negative.

The abdominal wall was flabby, quite thin, with diastasis of the recti muscles so that palpation of the abdominal organs was greatly facilitated. There was visible peristalsis and peristaltic movements could also be palpated. A tumor in the umbilical region was recognized, spherical in shape smooth, tense, of an elastic consistence, and about the size of the head of a fœtus.

It could be moved in all directions and was independent of movements of respiration. The stomach and intestines could be recognized as independent of the tumor. Liver and spleen were in the normal position and not enlarged. The uterus was freely mobile in the normal anteflexed position and of a size corresponding to the third month of pregnancy. The right and left adnexa were palpable, not adherent, and free from contact with the tumor.

The urine contained no albumin, sugar or other pathological elements. Fæces were negative.

The probable diagnosis, considering the mobility of the tumor and its negative relations with the genital organs, spleen and intestines, was that of a cyst of the mesentery.

Under ether anæsthesia and with the assistance of Dr. Davanzo the abdomen was opened with a longitudinal median incision. As soon as the wound margins were separated a retroperitoneal tumor. presented to view. It was spherical, fluctuating, very mobile, but attached by a short pedicle. The stomach and transverse colon were displaced upward. The omentum was lifted and with it the transverse colon, the mesentery was incised and with it the posterior parietal peritoneum, when we came in direct contact with the tumor. The blood vessels which presented were ligated, the tumor was disengaged gently and cautiously from its abundant adhesions. The short pedicle was thus reached which united the tumor directly to the head of the pancreas. Owing to the risks presented in working in a field presenting so many difficulties, it was decided to resect the tumor with its pedicle and ligate the stump. After the tumor was removed some white round vesicles full of clear liquid remained and were identified as echinococcus cysts. These were carefully excised. The pedicle was fixed to the peritoneum and with it to the abdominal wall. A drainage tube was inserted as suppuration was present in the abdomen. The extirpated tumor was as large as the head of a fœtus: the longitudinal diameter was 18 centimeters, the transverse diameter 12 centimeters, and the circumference 30 centimeters. The tumor was perfectly smooth

with a wall 1 centimeter thick. It contained numerous cysts of various sizes, white in color, and full of a transparent fluid. These were daughter and granddaughter cysts of a unilocular echinococcus cyst. The fibrous wall was thick and resistant. The postoperative course was of the best, the patient had no fever. Drainage decreased daily. The drainage tube was withdrawn leaving a 5-centimeter fistula. On the eighteenth day the patient suffered with severe metrorrhagia and with colic-like pains in the abdomen, similar to labor pains. The pain was due to an incipient abortion. Hæmorrhage as a result of the abortion was profuse and as it was only after 6 hours after the commencement of the hæmorrhage that proper treatment could be instituted, it was too late even to inject stimulants, and the patient died within 2 hours, from exsanguination.

At necropsy on the following day, Dr. Giachini found acute exsanguination of all the organs which were healthy. A stylet introduced in the fistula in the abdominal wall could be passed through for 5 centimeters or to the lower part of the head of the pancreas which was also enlarged, and here the fistula terminated. The other organs were free from parasites and the necropsy confirmed the diagnosis of unilocular echinococcus cyst of the head of the pancreas.

Cappelli. Policlinico, 1919, sect. chir.

G. H., age 72, native of Romagna, had a hydatid cyst which was not diagnosed before operation, or, rather, a diagnosis was made of echinococcus cyst developed in the inferior posterior aspect of the liver. The cyst was suppurating. The patient had complained of digestive disturbances, gastralgia and had been fed almost exclusively on fluid substances. Examination showed in the highest part of the epigastric region immediately beneath the ensiform apophysis a slightly bulging area. Eliminating other possible diagnoses, a diagnosis was made of echinococcus cyst developed in the posterior part of the liver and extending between the liver and the stomach and pushing in front of the gastrohepatic omentum.

At operation (the cyst was opened through the gastrohepatic omentum), we found that we were mistaken in our diagnosis as to the site of the tumor. The cyst had developed from the pancreas without producing any symptoms whatever due to the location. No examinations for the presence of possible pancreatic ferments were made after operation because the liquid was lost.

Recovery was more rapid than usually follows the treatment of cysts by the method of marsupialization. The rapidity of recovery was due in part to the easy enucleation of the cyst, except for the resistant adhesions. The cyst was almost spherical in shape, with its neck implanted upon the pancreas. The cystic infundibulum which remained easily developed adhesions on the internal surfaces eliminating the cavity. If the special characteristics of the cyst and its anatomic relations with surrounding organs and tissues had not permitted a free enucleation and direct observation, the cyst even at operation would certainly have passed for one of the liver.

Cases taken from the records of Hauser:

Pean. Patient, age 27, had been given up as incurable and had been in a condition of great nervousness and extreme debility for the past 2 months. He presented upon admission a cystic tumor situated in the upper part of the mesentery. Operation was performed on April 23 by Dr. Barrault. It was necessary first of all to separate the extensive adhesions. After having liberated the inferior part of the duodenum and the jejunum, it was found that these had been fused with the external lamino of a cystic tumor which covered the pancreas. Exploratory puncture resulted in obtaining two liters of clear liquid which contained scolices of echinococcus. After the incision and extraction of the hydatid, it could be seen that the cyst belonged to the pancreas. Recovery retarded by fæcal fistula.

Bobrow. N. E., age 27, a retired official, was operated upon in 1897. Symptoms before operation were nausea and oppression in the region of the epigastrium, dyspepsia, and icterus. The liver was rather hard and enlarged and its surfaces smooth and shining. The gall bladder was larger than a hen's egg, tensely distended by a liquid content, and could not be reduced in size by pressure. The common bile duct was also distended and about the size of a finger. It was adherent to a globular fluctuating tumor located apparently in the head of the pancreas. The duodenum resembled an aplastic tube and ran underneath the tumor. Diagnostic puncture resulted in the release of a clear transparent liquid in which succinic acid was immediately found. The intervening tissues were penetrated through the entire thickness of the pancreas, and the cyst was found at a depth of about 2 centimeters. The cyst was extracted *in toto*. Patient recovered.

Vegas and Cranwell. A boy of 14 years, of French nationality, had been in Buenos Aires for 5 years. Five months ago he complained of icterus of variable intensity. The urine was darkly colored. For some time he had complained of pain on the right side of the thorax. Upon admission October, 1900, the skin presented a greenish olive color varying to yellow. The same color was present in the mucous membranes, and particularly the scleræ. Heart and lungs were negative. Upon inspection of the abdomen a moderate dilatation in the region of the liver was noted. Patient was then examined under ether. At the upper part of the gall bladder was a tumor the size of a pear and below this a second more voluminous one, which could not be exactly outlined. There were great quantities of biliary pigments in the urine, but no albumin or sugar. Exploratory laparotomy was performed, with uncertain diagnosis. Because of the probability of the presence of gall stones the greatly distended gall bladder was opened up. A dark liquid, thick, and viscous was obtained in which was sand and small stones. The common bile duct was not obstructed. After suturing the gall bladder the

tumor was recognized, situated in the deeper part of the head of the pancreas. Puncture of the cyst showed the content of clear, watery liquid. The chitinous membrane was incised and extracted and the wound closed. Because of the danger of infection the wound was opened up on the third day, followed by the discharge of pus. Fever gradually disappeared. Icterus faded. Patient recovered.

Martin. (Clin. Chirurgica. Greifswald. Prof. Bier.) A servant, age 71, had been ill for 7 months. He complained of severe pains in the shoulders, nausea and acid eructations, pains in the stomach and vomiting of blood ever since the illness. In April, 1902, he vomited daily after eating, showing evidences of obstruction. He was sensitive to pressure in the umbilical region and left side of the abdomen. Stomach was negative to physical examination. The tongue was coated. Below the stomach a resistant tumor was palpated which was deeply situated and yet reached to the anterior abdominal wall. The proof of dilatation of the stomach is seen in a slight displacement of the tumor. Examinations of the stomach contents were all negative.

The diagnosis lay between indurated ulcer of the stomach and pancreatic tumor. After opening the abdominal cavity it was evident that the tumor was of the pancreas. It was about the size of a fist, and upon opening it echinococcus cysts escaped. As the pyloric walls appeared thickened and indurated a gastro-enterostomy was performed. Recovery was uneventful. About 6 months later the abdominal pains and bad general condition returned. No resistance could be palpated in the depths, however.

Villar. Villar operated upon a patient for hepatic echinococcus in May, 1900. In July, 1902, he operated again finding twelve cysts in the greater omentum and mesentery. Two were found in the spleen, one of which was extirpated with a portion of splenic tissue and the other sutured to the abdominal wall. A cyst, about the size of a mandarin orange, was found in the pancreas. As this cyst could not be extirpated the method of "capitonnage of Delbet" was tried. The patient was discharged on August 5, completely recovered.

Yonnescu. Patient, age 44, was admitted October 17, 1904. He had an abdominal tumor almost the size of an orange between the epigastrium and right hypochondrium. Lateral mobility of the tumor was quite marked. The tumor also moved vertically with the liver following respiratory movements. The general condition of the patient was bad. He was cachectic, icteric, and fats were eliminated in the fæces without digestive change. At operation on October 26, 1904, a hydatid cyst of the head of the pancreas was found which had ruptured during manipulation. The germinative membrane was extracted, the content of the cavity mopped out with sterilized compresses and the entire cyst sutured, thus eliminating the cavity. After the operation icterus disappeared, the general condition improved and digestion of fats was better. Patient was discharged recovered on November 23, 1904.

Mokrowsky. P. E., age 25, employed as a clerk. Patient was admitted September 17, 1902. Complained of a tumor in the region of the stomach which had been present for about 2 years. In the beginning it was about the size of a walnut, painless and disappearing with pressure. It was more easily palpated 2 hours after a meal. A year later the patient could distinguish another tumor behind the original one. This was also painless. In the last 4½ months he has had attacks of pain and evidences of obstruction. There has been no vomiting nor icterus at any time. The upper abdomen is distended. On the left side below the costal margin a prominence is seen. A tumor is seen extending both to the right and left of the median line in the upper abdomen. It is spherical but contains accessory bulgings. It follows the movements of the diaphragm in respiration. Palpation of the tumor is painless. There is a prominent bulging on the right which shows fluctuation. A similar prominence on the left side is dense and non-fluctuating. Both prominences are of almost the same size, about 6 to 7 centimeters in diameter. They are not situated similarly with relation to the linea alba, the left bordering the linea alba, and the right being 4 centimeters outside. The percussion of the tumor gives a dull sound which merges with liver dullness. The area of splenic dullness is separated, however, by a tympanitic zone next to the tumor dullness. Diagnosis: echinococcus cyst of liver.

Operation. September 26, 1902, by Professor Bobroff. The tumor appeared below the liver after incision of the overlying lesser omentum. Thus was exposed the duodenum which had been displaced to the right more toward the inferior border of the tumor. It could be seen at this point that the tumor belonged to the head of the pancreas. The tumor was a little larger than the head of an infant, of firm consistency and somewhat fluctuating.

Upon opening the tumor a small amount of green, purulent material was first obtained, soon followed by the discharge of a clear, watery liquid in which were daughter cysts.

Ribera y Sans. A. P., a woman, age 21. A diagnosis was first made of echinococcus cyst of the liver. Later it was thought the tumor was of the epigastric region and united with the liver and spleen. It was smooth, spherical, and tensely distended. Two years ago she was first troubled with pains in the right shoulder and compression of the tumor was painful. It later disappeared as symptoms of advanced cardiac disease progressed and finally terminated fatally. Laparotomy, January 23, 1893, proved the tumor to be a cyst of the pancreas. The patient left the clinic on February 18, 1893, completely recovered.

Lejars. Patient was a woman, age 55, who for the past 12 years had observed a tumor in the left upper quadrant of the abdomen. There had been a gradual increase in size, especially during the past 12 days, during which there had been fever and pain. Infection was greatly accentuated. At opera-

tion an adherent sac was found, which, upon incising, discharged numerous echinococcus cysts, some of which were quite large. The wall of the cyst was partly incised and resected, the deeper margins being clearly identified as belonging to the pancreas. The margins of the cavity were sutured to the abdominal wall. Patient died a few days later.

Briggs. Patient was a woman, age 45. She had taken sick about a year ago of stomach disturbances, often vomiting a bloody material. Emaciation was marked. Seven or 8 months later the abdomen began to enlarge. Briggs found a tumor at operation which was identified as certainly growing from the pancreas. Upon puncturing the cyst he obtained a dark colored liquid which contained remnants of hydatids. The tumor was resistant, smooth, and of the shape of a ball. It was located in the epigastrium and left hypochondrium, was mobile, and followed even slight respiratory movements.

The abdominal wall was incised from the xyphoid process to the umbilicus. A tumor was found adhering to the greater omentum, transverse colon, and stomach. By means of these adhesions a median fibrous union of several inches in length was formed. The adhesions were separated and the tumor extracted, together with the tail of the pancreas. Recovery was rapid and uneventful. Patient returned to work and gained rapidly in weight.

Microscopic examination showed the presence of a spindle celled sarcoma, which had arisen from the hydatid sac, as shown by the scolices in the neoplastic area. This case has also been reported by Mayo-Robson.

It seems that Hauser's cases are not all genuine cysts of the pancreas, also that some are only incidental to hydatid cysts of other organs. Capelli reduces the statistics to 16 cases, 6 of which were verified at autopsy, and he has added 1 case of his own. Since his article other cases have appeared in the literature: those of Verdelet, Phillips, Muller, Parlavecchino, Threudart, Graglietto, and that reported by Cardarelli and operated upon by d'Antoni. (Carozzi. La Cirugia del Pancreas, Bologna, 1919.)

THE ICTERUS INDEX OF THE BLOOD SERUM

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THE laboratory tests reported in this paper were undertaken with the object of ascertaining whether the determination of the icterus index of the blood serum gives a definite idea of the degree of jaundice, and whether it can serve as a guide to the increase and decrease of jaundice, during the progress of a disease.

The color of the skin and scleræ, and tests for bile pigments in the urine, are the means generally relied upon by clinicians to indicate the presence or absence of jaundice. Inasmuch as these methods are, at best, rather crude, a more delicate and accurate form of determining the presence and degree of so important a symptom appears most desirable. Since the bile is carried through the blood stream before its elimination in the urine, the estimation of the bile pigments in the blood serum should give definite information regarding the presence and intensity of icterus.

Muehlingradt[1] has recently described a method for determining bile pigments in the blood. Briefly, it consists of comparing blood plasma with a standard solution of bichromate of potash and diluting the plasma with physiological salt solution, until its color approaches that of the standard. The potassium bichromate solution (1:10,000) is approximately equivalent to the color of a non-icteric plasma.

I have modified this method, using serum instead of plasma. The technique is as follows:

A solution of potassium bichromate 1:10,000 is used as a standard. Five to 10 cubic centimeters of blood are obtained, and the serum allowed to separate. The serum is compared in a colorimeter (Duboscq) with the standard bichromate solution. The standard may be set at 10, 15 or 20 millimeters. The icterus index is obtained by

[1] Muehlingradt. Deutsch. Arch. f. klin. Med., 1921, cxxxvii, 1-2.

dividing the reading of the standard by the reading of the unknown. When the color of the serum is too dark and cannot be compared with the standard solution, the serum is diluted with physiological salt solution, until its color approaches that of the standard. The calculation is as follows:

$$\frac{R_x}{R_s} D = \text{Icterus index}$$

R_x = Reading of unknown

R_s = Reading of standard

D = Dilution.

Normal icterus index. In the 156 cases giving no clinical evidence of jaundice, the lowest value obtained was 1.6 (No. 4183, fracture of skull), while the highest was 12 (No. 3757, pernicious anæmia), the average being 3.6. Eleven cases showed a higher figure than 5, but less than 11; these were classified as follows: carbuncle of neck, 4 cases of post-operative hernia, cardionephritis, hæmorrhoids, pernicious anæmia, and a subacute appendicitis. One hundred and forty-four cases varied between 2.5 and 5. An icterus index varying between 2.5 and 6 may be considered as normal.

It is of interest to note that the cases of pernicious anæmia, with one exception, were within normal limits, notwithstanding the fact that all these patients had an icteric hue.

Icterus index in jaundice. The table shows the icterus index in 15 cases with jaundice. The values vary from 15 to 210. While the initial icterus index only is given in the table, many subsequent determinations showed that the gradual disappearance of the jaundice was accompanied by a decrease in the icterus index. The following cases illustrate the delicacy of the reaction.

Case No. 6138, toxæmia of pregnancy with acute yellow atrophy. The patient was admitted on October 12, 1921, intensely jaundiced. The icterus index was determined on the 13th, and was found to be 187. The urine showed a marked bile reaction and also leucin and tyrosin crystals. On October 21, the icterus index had decreased to 62, the patient still being considerably jaundiced. On October 25, the icterus index was further reduced to 31, the color of the skin was somewhat lighter than before, and the urine still showed the presence of bile. On October 31, the icterus index was 23, and on November 11, it was 14. Between October 13, when the index was 187, and October 21, when it had decreased to 62, no appreciable change in skin coloration could be detected, while the icterus index indicated a definite decrease in the amount of jaundice.

ICTERUS INDEX IN FIFTEEN CASES

Case No.	History	Icterus Index	Diagnosis	Remarks
4	....	128.2	Acute catarrhal jaundice	6 weeks' duration. Recovered.
5	....	15.2	Chronic catarrhal jaundice	At times skin slightly colored. Recovered.
46	3205	112	Acute hepatitis	Intense jaundice. Not improved.
50	3239	56	Cholecystitis	Jaundiced.
35	....	43.6	Catarrhal jaundice	Recovered.
100	3978	75	Gall stones	Considerable icterus. Bile in urine. Died after operation.
155	4440	150	Obstruction of common duct	Intense jaundice with bile in urine. Died.
173	5883	200	Acute yellow atrophy following salvarsan	Jaundiced. Bile, leucin, and tyrosin in urine. Died.
174	6409	56	Carcinoma of colon	Faint icteric hue. Died.
175	6075	62	Catarrhal jaundice	Skin slightly colored.
176	6920	39	Catarrhal jaundice	Patient jaundiced.
177	D319	70	Hypertrophic cirrhosis	Skin slightly colored.
178	6138	187	Acute yellow atrophy. Toxæmia of pregnancy	Bile, leucin and tyrosin in urine. Skin jaundiced. Recovered.
179	7368	210	Cholecystitis	Deeply jaundiced. Bile in urine.
180	6771	92	Gall stones	Skin deeply jaundiced. Died.

Case No. 3205, acute hepatitis in a male. The icterus index was 112 on admission, the patient showed marked jaundice, and bile was present in the urine. The subsequent determinations of the icterus index, one week apart, were, 111, 108, 103, and 105. During this time the variation of the icterus index was very slight, indicating no change in the amount of jaundice. The skin coloration remained the same.

Case No. 6409, male, carcinoma of colon, admitted October 25, 1921. The scleræ and skin of this patient were normal in appearance, and the icterus index was 12. No bile was demonstrable in the urine. At operation metastases to the liver were found, thus explaining the pathological index of 12. After operation, a jaundice developed and the icterus index rose to 56, bile being present in the

urine. Death of the patient prevented further observation.

Case No. 5883, female, acute yellow atrophy of liver, following salvarsan injection. One day before death the icterus index was 210, and bile was present in the urine.

Case No. 6771, female, cholecystitis, with common duct obstruction. The patient was admitted to the hospital on November 9, 1921, with considerable jaundice. On November 10, the icterus index was 92 and bile was present in the urine. On November 17, the icterus index rose to 120. The patient was operated upon November 19, and died on the following day.

CONCLUSIONS

The icterus index is of value in determining the presence of jaundice, and offers a more delicate and accurate means of ascertaining the increase or decrease of jaundice than does any clinical or laboratory test now generally in use.

I wish to thank Dr. De Witt Stettin, attending surgeon, for suggestions which led to the consideration and development of this problem and Adolf Bernhard, who is in charge of the chemical laboratory, for having given me valuable assistance in working it out.

A PATHOGNOMONIC SIGN OF INTRA-UTERINE DEATH[1]

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DEATH of the fœtus *in utero* is a sufficiently common occurrence to justify the presentation of any additional diagnostic aids that may be discovered. Heretofore the history, together with the subjective symptoms and the physical signs, have been the factors utilized to arrive at a diagnosis of intra-uterine death. Laboratory tests have been unsatisfactory.

In regard to the past history, syphilis, either in the father or mother, chronic nephritis in the mother, or habitual death of the fœtus from unknown causes, are the suggestive points. The patient may or may not complain of malaise with bad taste in her mouth, feeling of weight in the abdomen, nausea and vomiting, breast changes, failure to feel life, or discharge of blood or clear fluid from the vagina. The attendant may or may not note changes in the blood pressure, a slight rise in the body temperature, or a subnormal cervical temperature, stationary weight and stationary or diminished height of the fundus of the uterus, or possibly may elicit crepitation in the fœtal head bones by vaginal or abdominal palpation.

The last sign is practically the only positive diagnostic sign existing at present. In the Women's Clinic of Stanford University we have, during the past few months, made positive diagnoses of intra-uterine death by the aid of X-ray pictures of the fœtal skull, and from a review of the literature this seems to be an original observation.

It seems that very shortly after intra-uterine death, the brain tissue shrinks, which produces a typical overlapping of the fœtal skull bones. This overlapping of the fœtal skull bones seems to be pathognomonic of the condition of the intra-uterine death and gives a picture quite different from the overlapping produced by molding.

With the X-ray, the decreased size of the fœtal head from post-mortem shrinking can be determined because the cranial bones remain nearly the same size and shape. As the head shrinks, the bones overlap at times to an astonishing distance. The radius of curvature of the shrunken head becomes obviously smaller than that of the unchanged cranial bones. When both the above changes are noted in the X-ray picture it seems justifiable to conclude that the child is dead and such has been our experience in the X-ray study of 21 babies *in utero*. In this series, 3 babies were dead and presented the typical findings; 18 were alive, of which 17 showed no changes in the X-ray picture of the fœtal head and the suture lines. One baby showed marked overlapping of the skull bones due to molding caused by a long first stage of labor, but in spite of this overlapping, the skull

[1] Read before Society of the Alumni of the Sloane Hospital for Women, April 28, 1922.

Fig. 1. Shows fœtal skull of dead baby. There is extreme overlapping of the fœtal skull bones (see arrow) and the skull surface is seen to be much larger than the bulk of the skull contents.

Fig. 2. Shows overlapping of skull bones with marked shrinking of skull contents (see arrows). The skull bones show no evidence of pressure.

bones showed no disproportion in relation to the bulk of the contents of the skull.

The following are the histories of the three patients with intra-uterine death:

CASE 1. Mrs. B., Clinic No. 97829, age, 42, gravida 1, para-0, registered in the Women's Clinic, Stanford University School of Medicine, August 22, 1921. She complained of amenorrhœa since May 13, 1921; no nausea; occasional headaches; pains in lower abdomen.

September 16, the fundus measured 14 centimeters above symphysis. The pelvis was normal. Labor was due, by Naegle's rule, February 20, 1922. Patient felt life on October 12. Blood pressure: 130–80.

December 13, she complained of pains low down in pelvis. She had not felt life since December 2 and thought her abdomen was getting smaller. She had a constant salty taste in her mouth. Blood pressure: 138–94. Fundus 18 centimeters above symphysis.

December 19, fundus 21 centimeters. No fœtal life. Head could be felt by bimanual examination and thought to feel soft. Patient vomited every morning. She entered hospital. Hospital history states that patient has had measles, scarlet fever, and diphtheria. Appendectomy had been done three years ago. Blood pressure: 125–85. No fœtal heart heard. Braxton Hicks contractions were present, but no fœtal movements were noted. Fœtal head could be felt above cervix, but did not give the characteristic hard feel.

Fundus measurements were as follows:

	Centimeters
September 16, 1921	14
November 30, 1921	18
December 13, 1921	18
December 20, 1921	18

December 20, 1921, X-ray picture of uterine contents showed overlapping of the fœtal skull bones with apparent shrinkage of the skull contents (Fig. 1). A diagnosis of intra-uterine death was made and labor was induced December 22 with Voorhees bags. She was delivered of a dead baby December 23. The liquor amnii was dark and dirty looking. The head was soft, showing beginning maceration. The legs and feet and parts of body were macerated. The fœtus had apparently been dead for some time.

Examination of the placenta showed many white infarcts; otherwise normal. The Wassermann was negative. Blood count: 4,024,000 red cells; hæmoglobin, 85 per cent; leucocytes, 7,000; polymorphonuclears, 69 per cent; lymphocytes, 25 per cent.

Fig. 3. Shows fœtal skull of dead baby. There is marked overlapping of the fœtal skull bones (see arrow) with some disproportion between surface of skull bones and skull contents.

Fig. 4. Shows the fœtal skull of normal pregnancy.

The urine was normal except that specific gravity varied from 1026 to 1008.

Autopsy on the baby showed definite widening and irregularity of the epiphyseal line of the rib and femur. The lungs showed definite fibrous thickening of the septa of the alveoli, otherwise negative. Diagnosis: congenital syphilis.

CASE 2. Mrs. T., Clinic No. 74294, age 29, gravida 2, para-1, registered in Clinic September 21, 1921. December 30 her blood pressure was 144–90. She had been delivered by Cæsarean section on May 10, 1919, of a live baby because of eclampsia with marked œdema, granular casts, and blood pressure of 210–140.

January 13, 1922, her blood pressure rose to 160–100. Headache and œdema of legs. She entered hospital. Labor was due March 22. Fundus measured 22 centimeters above symphysis. Fœtal heart was heard in right lower quadrant. Patient left hospital February 3 with a blood pressure of 145–100, to be observed by the Social Service Department.

February 23 re-entered hospital with blood pressure of 140–85, no toxic symptoms, fundus measuring 21 centimeters. Fœtal heart could not be heard, and an X-ray picture of the abdomen was taken. This picture showed the typical findings of intra-uterine death (Fig. 2).

Shortly after returning from the X-ray Department, the membranes ruptured with a discharge of a quantity of dark coffee-colored, amniotic fluid. A dead baby was delivered with easy low forceps, and immediately after labor patient's blood pressure was 130–82.

Examination of placenta showed white infarcts with signs of infection in the placenta; otherwise normal. Wassermann was negative. Blood examination showed 4,120,000 red cells, hæmoglobin 90 per cent, 10,400 white cells, 76 per cent polymorphonuclears, 20 per cent lymphocytes. Urine examination showed a low specific gravity with light cloud of albumin but no casts.

Autopsy on the baby showed definite widening and irregularity of the epiphyseal line of the rib and femur. Diagnosis: congenital syphilis.

CASE 3. Mrs. A., Clinical No. 100933, age 38, gravida 2, para-0, registered in Clinic December 9, 1921. Last menstruation was April 1. She gave no history of infections. She has had some swelling of feet and hands during present pregnancy. Married 20 years; spontaneous abortion at 4 months 10 years ago. Heart and lungs negative. Breasts large. Fœtal heart faintly heard in left upper quadrant. Child lying in occipitolaevo-anterior position. No engagement of presenting part. Fundus was 33 centimeters above symphysis. Pelvic measurements were normal. Labor was due January 8, 1922.

December 20, fœtal movements were very active. Blood pressure, 174–88.

January 4, 1922, because of hypertension, patient was given castor oil and quinine, but no labor pains resulted. Blood pressure, 146–80. Fundus was 33½ centimeters above symphysis. Fœtal heart sound in right lower quadrant, strong, regular, rate 140.

January 27, patient entered hospital with blood pressure of 150–90. Fundus 29½ centimeters above symphysis. Fœtal heart could not be heard. Janua y 28, fœtal heart could not be heard; no fœtal movements. Braxton Hicks contractions present. Blood pressure 140–85. Bimanual examination of fœtal head gives an impression of crepitation in the skull bone, but this is not distinct.

Fundus measurements have been as follows:

December 9, 1921	33
December 20, 1921	33½
January 26, 1922	29½
January 29, 1922	29

X-ray picture of contents of uterus shows a well-grown fœtus with head floating. There is a little shrinkage of the head as evidence of overlapping of the sagittal suture (Fig. 3). Diagnosis: intra-uterine death of fœtus.

January 30, spontaneous labor began and patient was delivered of a dead baby.

Examination of placenta was normal. Wassermann negative for both husband and wife. Examination of blood shows hæmoglobin 75 per cent, 9,250 white cells, polymorphonuclear 66 per cent, lymphocytes 24 per cent. Urine examination normal, except for a slight trace of albumin.

Autopsy on the baby showed very marked widening and degeneration of the epiphyseal line of the rib and femur. Diagnosis: congenital syphilis.

CONTROLS

The fœtal skull *in utero* has been studied by means of X-ray pictures in 27 patients with normal pregnancy. In no instance can there be seen any overlapping of the fœtal skull bones or any diminution in the size of the skull contents (Fig. 4).

One patient with normal pregnancy had rupture of the membranes with beginning labor. She had a long first stage of labor lasting 43 hours, due to rigidity of the cervix, but was eventually delivered of a live baby. An X-ray picture taken late in the first stage of labor shows marked overlapping of the fœtal bones, but there is no sign of diminution of the skull contents. This overlapping can be easily differentiated from that produced by intra-uterine death (Fig. 5).

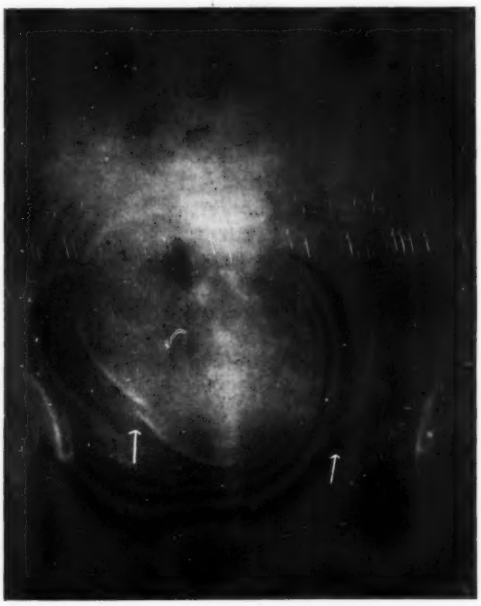

Fig. 5. Shows the fœtal skull of live baby with overlapping of skull bones (see arrows) due to long first stage of labor. There is no diminution of the skull contents as shown by the bulging of the skull bones between the lines of suture. The right pubis indents the coronal suture.

CONCLUSIONS

From a study of fœtal skulls with the X-ray in 31 cases of pregnancy, it has been found that with live babies the fœtal skulls appear normal except for the effect of labor which produces an overlapping of the skull bones. In three cases of intra-uterine death, the X-ray picture showed the marked overlapping of the skull bones with distinct signs of shrinkage of the skull contents.

From these facts we believe it is justifiable to state that shrinkage of the skull contents with overlapping of the skull bones can be demonstrated with the X-ray, which gives a pathognomonic sign of intra-uterine death.

Thanks are due to Dr. Hans von Geldern, resident in obstetrics and gynecology, for assisting in the study of these cases, and to Dr. R. R. Newell, assistant roentgenologist in the Stanford School of Medicine, who made the photographs and interpreted the X-ray findings.

ELEPHANTIASIS TREATED BY THE KONDOLEON OPERATION

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A NUMBER of articles have appeared in medical literature, discussing the Kondoleon operation for the relief of elephantiasis of the extremities. As this condition is rare in the United States, we have but a limited number of cases upon which to base statistics of end-results. Since the degree of value of the operation is still debatable, all cases of this kind should be duly reported. Devised by Kondoleon, of Greece, it has been employed by Matas, Royster, Hill, Sistrunk, and others in this country. It cannot be considered a cure for elephantiasis, but is assuredly the best step so far introduced, tending to make lymphatic obstruction of limbs bearable and controllable

Elephantiasis, we will remember, is pathologically due to an obstruction of the lymphatic vessels of the part, resulting in hyperplasia of the skin and tissues, which macroscopically are thickened, waxy, and indurated.

In selecting a case for operation the following should be observed: (a) Blood Wassermann must be negative, hæmoglobin, at least 70 per cent. (b) Patient's general health must be carefully considered. Operation should not be undertaken in the presence of an active dyscrasia. Existence of a curable chronic trouble need not stand in the way of hope for a future operation. For example, one of my cases suffered from an acute empyema and fibroid tuberculosis 2 years before one leg was surgically treated. (c) Every means of reducing the size of the limb must be thoroughly tried previous to surgical interference, such as rest in bed and elevation of the member; care of the skin, particularly if ichthyosis and local patches of infection exist; massage; employment of elastic bandage or stockinet.

My practice has been to prepare cases in this manner, beginning 2 to 4 weeks prior to operation. These precautionary measures reduce the chance of infection and put the affected area into a more pliant state.

The principle of the operation is the establishment of a connection between the superficial and deep lymphatics — the latter generally being uninvolved. This is done by permanently breaking the fascial wall lying between the muscles and subcutaneous tissues, boldly removing wide wedges of tissue from the inner and outer aspect of the entire length of the affected limb, each wedge comprising skin, fat, and deep fascia (9).

If the enlargement is not extreme at the joints, it is an advantage to break the incision opposite them, thus avoiding a skin scar at these points. These cutaneous bridges are readily undermined, allowing an easy removal of the required amount of fascia and infiltrated fat. I do not stitch the fascia, for this tissue is usually so thick and waxy that it seems unnecessary to tack it in place. The muscle substance is not to be broken into. This point is important, for it eliminates the chance of painful adhesions. An assistant inserts dry gauze packs as fast as the sluices are cut, over which the flaps are firmly compressed, following the operator as he proceeds. After the entire sulcus has been fashioned, the larger bleeding points are caught but not ligated until all secondary trimming has been completed, thus avoiding re-tying.

I employ drainage, because this is an aid to the general reduction of the limb, allowing lymphatic material to escape; besides, it is the logical thing with so much raw surface.

It is inadvisable to operate upon both sides of the limb at one time, the better plan being to attend to corresponding sides of the extremities at the same sitting. In the leg the outer surface should be attended to first, because, when operating upon the inner aspect the long saphenous system is necessarily interfered with, which tends to throw an added strain upon the drainage of the leg. At the second sitting there is already established a communication between the deep and superficial lymphatics of one side of the leg and a general reduction of the limb having taken place, the saphenous vein and its tributaries can be better spared. The one

a *b* *c*

Fig. 1. Case 1. *a*, 6 months before operation, calf 26 inches, thigh 27 inches. *b*, 2 months after final operation, normal leg, calf 12½ inches, thigh 13½ inches, affected leg, calf 13 inches, thigh 14 inches. *c*, One year after operation, calf, 14½ inches, thigh 15 inches. Note slight tendency to enlargement. Tissues, however, soft and pliant.

advantage of the asymmetric plan of attack is that it allows the patient the comfort of lying upon one side.

The second operation should not be undertaken until at least 6 weeks after the primary and not then if there is a discharging sinus along the track of the former incision. After operation, the limb should be firmly bandaged and elevated and if drained, dressed daily. Patient should not be allowed to hang member down, or step upon it for at least a month after operation and then should not do so without the employment of a pressure bandage or elastic stocking.

The patient must not be led to believe that a complete cure requiring no further attention can be attained. It must be made clear that some sort of support, preferably in my opinion an elastic stockinet, must be worn for the balance of life. Also, light massage must be employed from time to time.

In summarizing my experience with the operation, I glean the following facts:

1. The Kondoleon operation is a commendable surgical procedure and the only one that gives any real relief.

2. It is not a curative operation, for there is a tendency toward return of the enlargement of the involved extremity, especially if unsupported.

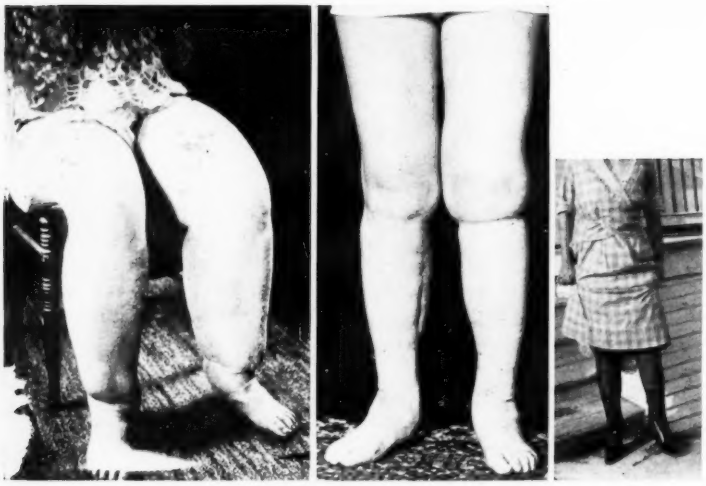
3. Its recurrence in most cases can be held in check much more readily than the original enlargement could be controlled.

4. Patient is rendered decidedly more comfortable and does not suffer from pain or ill effects following the operation.

I submit three case reports as follows:

CASE 1. H. W., female, white, age 23. Twelve years ago patient noticed slight swelling in left ankle every evening. It was painless at first, but after 4 months was painful. Swelling gradually spread over entire leg and became permanent. Eight years ago leg attained its maximum size, and the tissues became more brawny. Two years ago patient's general health declined and a diagnosis of fibroid phthisis was made; shortly after, patient underwent empyema operation. Following this, she came under my care suffering with marked secondary anæmia and fibroid pleurisy. One and one-half years ago she had sufficiently improved to warrant Kondoleon operation. The outer surface of leg was attended to, and in 6 weeks the inner side. Though there has been some recurrence, she is highly satisfied with result and is ready again to undergo operation, if necessary.

CASE 2. Mrs. H. B. M., female, white, age 40. Twenty-one years ago patient noticed swelling of the ankle of left leg. This gradually grew more marked and became permanent. Four months after, swelling developed in right leg. Both limbs increased in



a *b* *c*

Fig. 2. Case 2. *a*, 2 years before operation. *b*, 4½ months after final operation. *c*, 4½ months after final operation. (Notice how comfortably she wears shoes and stockings.)

size and induration until 8 years ago, when maximum size was attained. This maximum size continued until the operation, except in the right thigh, which, a few months before the Kondoleon, diminished slightly in circumference, and was painful. Patient had all palliative forms of treatment before June 30, 1921 (date of operation). The outer sides of both limbs were operated upon, and 6 weeks later the inner surfaces. So far she is well satisfied with result.

CASE 3. Mrs. S., female, white, age 42. Following childbirth she noticed swelling in right calf, attended by slight soreness. For 3 years, this swelling gradually increased and the leg became brawny and indurated, and unwieldy to move. There was no swelling above the knee. Circumference was 7.5 inches larger than the normal leg. Re-examination 18 months after operation, discloses slight tendency to enlargement. Possibility of recurrence had not been explained to patient and she is not well satisfied with result.

Fig. 3. Case 3. 1½ years after operation,—slight tendency to return though tissues are soft. There is still a reduction of 6 inches from the original enlargement.

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TRAUMATIC ORBITOFACIAL EMPHYSEMA

By GEORGE G. DAVIS, M.D., F.A.C.S., Chicago

TRAUMATIC facial emphysema is not a common complication of face injuries, but when it occurs it is usually secondary to fractures of the nasal bones. More rarely it occurs from fracture of the lacrimal, ethmoidal, or frontal bones. Brav (1) reported a case of orbitopalpebral emphysema caused by perforation of a dental canal.

In Brav's case, a dentist, while drilling on the mesial root of the right upper first bicuspid accidentally perforated, by way of the dental canals, into the antrum of Highmore and farther through the bony roof of the antrum, making an opening through which air escaped into the subcutaneous tissue. Immediately following the accident, the lids of the right eye began to swell until the eye was entirely closed and this emphysematous condition quickly involved the right side of the face as far down as the neck, giving an asymmetry of the face as the result of the unilateral swelling, which was rather hideous in appearance. The patient suffered no pain from the condition. A pressure bandage was applied for 2 days, and the emphysema disappeared at the end of 5 days.

Potter (2) reported a case of hydropneumo-cranium, with air in the ventricles, which was the result of a fracture of the frontal bone. The patient, a male, aged 40 years, fell from a height of 15 feet, striking mainly on his hands and face. Skull plates disclosed a frontal skull fracture, comminuted, somewhat stellate, centering about the right supra-orbital arch, and involving both the internal and external walls of the frontal sinus and the orbital plate. Inside the cranium, at the site of fracture, there was evidence of gaseous accumulation, in volume and shape comparable to a small hen's egg. This was noted 3 weeks after the injury. Two weeks later there was considerable increase in the volume of the subdural gas chamber, and the lateral ventricle was also appreciably gas-filled. The air in the cavity was displaced by fluid and gradually disappeared.

In 1905, McArthur (3) reviewed 33 cases of external pneumatoceles of which 23 were

Fig. 1. Roentgen-ray, anteroposterior view, taken December 4, 1921, one day after injury, showing semilunar shaped air spaces in the superior portion of either orbit.

Fig. 2. Roentgen-ray, lateral view, taken December 4, 1921, one day after injury, showing air spaces in the superior portion of the orbits and also the rather spacious pneumatic areas of the frontal sinus and thin walls of same.

Fig. 3. Photograph, taken December 7, 1921, 4 days after the injury, showing discoloration about the bridge of the nose and in the infra-orbital regions.

in relation to the mastoid and 10 to the frontal sinus. Ten developed after trauma and in 10 cases also there was evidence of pre-existing bone disease which was considered a predisposing factor to the development of pneumatocele after slight trauma. Also some history of increased air pressure in the buccal and oral cavities was frequently given.

J. K., a laborer, age 45, on December 3, 1921, was struck in the sacro-iliac region by a blow of considerable force, which caused him to fall forward on the floor, striking his face. He was taken immediately to the hospital, where it was noticed that he had a hæmorrhage from the nose, blood escaping from both nares. There was a contusion of the frontal region with marked swelling and discoloration at the bridge of the nose.

Shortly after the injury he blew his nose, following which, there was considerable swelling which came on rather suddenly. This extended upward well onto the forehead and downward, involving the bone of the nose and both cheeks and eyes. Palpation of the affected area produced a typical crackling, the skin felt as if it were floated up from the underlying bone by an effervescing liquid; the air could be driven from one place to another by the fingers, and pitting on pressure was apparent.

Skull plates taken the day following the injury showed air in both orbits, but no well-defined fracture could be noted. In the anteroposterior view (Fig. 1) semilunar-shaped air spaces were noted in the superior portion of either orbit. A lateral view (Fig. 2) also revealed the air spaces in the superior portion of the orbits and also rather spacious pneumatic areas of frontal sinus and its thin wall.

From the day of the injury, the swelling (emphysema) gradually decreased. On the fourth day there remained but one small area over the bridge of the nose that crackled on pressure. Discoloration (Fig. 3) of the tissues about the bridge of the nose and in the infra-orbital regions was marked at this time. Eight days after the injury another skull plate was made in an anteroposterior view (Fig. 4), and it was noted that the semilunar-shaped air spaces in the orbits had disappeared and there were no further signs of air being present in the tissues. At no time was there air within the cranial cavity, as seen in Potter's case, nor air between the cranium and periosteum as noted in cases of pneumatocele of frontal region reviewed by McArthur.

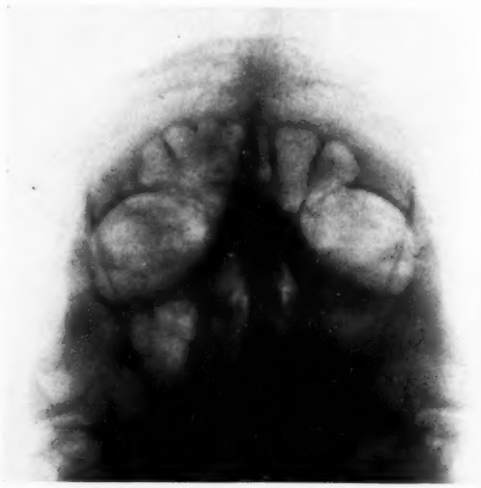

Fig. 4. Roentgen-ray, anteroposterior view, 8 days after injury, showing that the semilunar-shaped air spaces in the orbital regions have disappeared.

The manner in which the air entered the orbits and soft tissues about the upper half of the face in this case is not definite either from physical examination of the patient or roentgenographic examination of the skull. However, the skull plates disclose very large pneumatic spaces in the frontal sinuses, and the walls are very thin and irregular. It seems probable that a fracture of the frontal sinus entering into the orbits was present. The blowing of the nose, causing an increased air pressure in the buccal and oral cavities was the immediate cause of the sudden emphysematous condition.

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A STUDY OF EXPERIMENTAL PYLOROPLASTY[1]

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ONE hears from various sources expressions of dissatisfaction with present methods of dealing with pyloric obstruction. On the one hand, the operation of gastro-enterostomy, while technically a highly perfected operation and one which has done great service to mankind in the relief of suffering and the saving of life, is yet an operation which does such violence to the physiological relationships in the upper digestive tract that it must always fall far short of being an ideal surgical procedure. The complications and unfortunate sequelæ, which are sometimes met with, are well known and need no discussion. These and also those more vague after-effects, which sometimes follow this operation, while not of sufficient frequency to discountenance the operation, are yet a constant stimulus in the attempt to find a more physiological method of treatment. With regard to the various pyloroplasties, on the other hand, of all which have been devised, the relative infrequency with which any is used (with the exception of the Rammstedt operation in congenital stenosis) is eloquent testimony that they are surrounded by greater doubt and difficulty than is gastro-enterostomy.

It is not the purpose to discuss here the various pathological conditions of the pylorus which result in obstruction, nor the different operative difficulties to be overcome in dealing with the different lesions. Dogs, unfortunately, do not furnish obstructions at the will of the investigator, so we were compelled to work with normal tissues and have directed our attention to the general operative possibilities of this region rather than to the treatment of any particular lesion.

Our first problem was the adaptation to the pyloric region of the principles of pedicled flap operations which have gained such wide application in plastic surgery. Some difficulty was encountered in obtaining a flap to which a free blood supply could be preserved. This was finally done in the following manner. The proximal end of the duodenum and the adjacent end of the stomach were opened up by an incision starting on the ventral aspect of the duodenum about 3 centimeters beyond the pyloric sphincter and extending back through the pyloric sphincter and the ventral wall of the stomach to a point in the stomach about 4 centimeters proximal to the pyloric ring. From this point two curved incisions were made almost to the greater curvature of the stomach and including between them a flap of the stomach wall in the shape of a half crescent. This flap could always be so chosen that it had a good blood supply at its base from one or two large branches of the right gastro-epiploic artery. This crescentic flap was then drawn into the first incision, the tip of the flap fastened at the duodenal extremity of the incision, and, after trimming away any redundant mucosa, the flap was firmly fixed in its new location by a line of continuous suture carefully placed so as to secure complete hæmostasis and edge-to-edge approximation but no inversion of the edges. The incisions made in outlining the flap were closed by lines of suture extending to either side from the base of the flap. The plan of this operation is shown in Figures 1a and 1b.

The operation described was performed on a series of eight dogs. On four of these dogs, the incisions were made through all the coats of the stomach and duodenal walls. On the other four dogs of the series, an exactly similar operation was done, except that all incisions were made only to the

[1] The work upon which this paper is based was done in 1916 and 1917, in the Department of Surgical Research of the University of Pennsylvania, and the results were presented at the tenth annual meeting of The Undergraduate Medical Association of the University, April 20, 1917. Publication at that time was prevented by the military service of the authors.

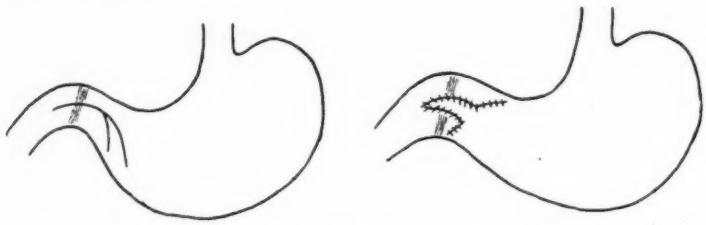

Fig. 1. *a* (at left), Incisions for the plastic flap operation. *b*, Lines of suture used in transplanting the flap into the pylorus and in closing the stomach incisions.

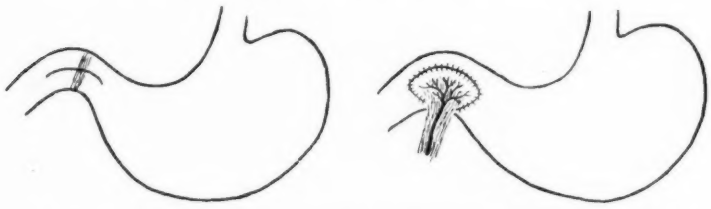

Fig. 2. *a* (at left), Incision of stomach and duodenum to receive jejunal transplant. *b*, Jejunal transplant sutured in place.

submucosa. Thus, without having entered the lumen of the stomach or gut, a seromuscular flap was taken from the wall of the stomach and sutured into the incision which had been made through only the outer coats of the pylorus. In these operations, if a double row of sutures is used, inverting the edges as is customary in gastro-intestinal work, the inverted edges encroach to such an extent on the lumen of the canal at the pyloric ring that the net result of the operation is to decrease the lumen and not to enlarge it. To avoid this and secure a true enlargement, we made a single continuous suture to secure edge-to-edge approximation but never any inverting suture to get contact of serous surfaces. Instead, the pylorus was covered with a free edge of omentum which was held in place with two or three interrupted sutures.

The recovery of all eight dogs was uncomplicated. The dogs were autopsied at dates varying from 2 weeks to 6 months after operation. None showed any extensive peritoneal adhesions or other evidence of peritonitis. In all, the pylorus appeared to be functioning normally. The omentum, somewhat thickened, was still closely adherent where it had been attached at the time of operation. No marked enlargement had been secured in any case. The seromuscular flaps showed a marked tendency to retract to the original site, leaving little evidence of ever having been in the pylorus. The flaps which included all coats retained better their new position and could be easily recognized on the mucosal surface where the strip of gastric mucosa contrasted sharply with that of the duodenum into which the flap extended. The tissues were healthy, but the flap dimensions were decreased, and the pylorus had returned to almost its normal size. In two or three cases where the retraction of the flap was quite marked, there was evidence that the flap had exerted a definite pull, for the duodenal mucosa had been thrown into folds which converged to the point where the tip of the flap was attached. It furthermore appeared that this "pull," acting on the muscular coats, was helping to restore the pyloric ring, for the cut fibers, which the flap had separated, were being brought close together as they were pulled after the retracting flap.

To test the action of the pylorus in the presence of a really marked enlargement, we next implanted into a large incision through

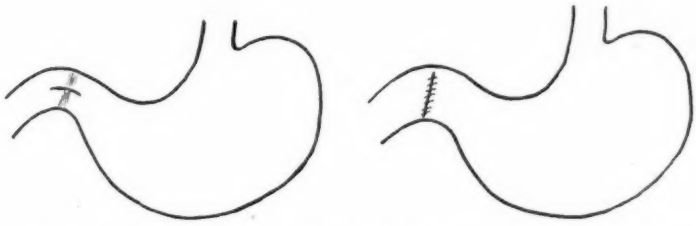

Fig. 3. *a* (at left), Incision for the Heineke-Mikulicz and Fredet operations. *b*, Transverse closure of pyloric incision in the Heineke-Mikulicz and Fredet operations.

the pylorus, a piece of jejunum which was obtained and inserted as indicated in Figures 2a and 2b. The segment of gut resected was opened along its antemesenteric line. The retangular piece of intestine, thus obtained, was trimmed to a suitable shape and sewed into the opening which had been made in the pylorus. A good blood supply was preserved for this flap by a mesenteric pedicle, containing one of the larger mesenteric branches.

The two dogs of this series made a good recovery. One, at autopsy 5 weeks after operation, showed the pylorus greatly increased in size by the large bulging flap. The flap tissue was healthy and was still getting some of its blood supply from the pedicle in which a pulsating vessel was easily seen. The other dog of this series, when killed 7 months after operation, showed a markedly enlarged pylorus with the flap tissue healthy, but there had been a slight decrease in the size of the transplanted flap and the mesenteric pedicle, with its blood vessels, was reduced to a thin fibrous band.

Next, on a series of four dogs, we performed an operation as illustrated in Figures 3a and 3b. This is the Heineke-Mikulicz operation slightly modified, in that the sutured edges were not inverted and, in two of the dogs, the incisions were made only down to the submucosa, as done by Fredet (1). These operations gave, at the time of operation, a moderate enlargement of the pylorus, but when autopsied, at periods varying from weeks to months after operation, none of these animals showed any permanent enlargement of the pylorus.

On another series of eight dogs, we performed the Rammstedt operation (2), with the exception that whereas the Rammstedt operation is merely an incision through the muscular coats of the pylorus allowing the mucosa to bulge, we, in some of the dogs, to exaggerate this and test the safety of the procedure, resected a strip of the serous and muscular coats to allow still greater prolapse of mucosa (Fig. 4). In a few cases, while resecting the seromuscular strip, the mucosa was accidentally punctured and had to be closed with a fine purse string suture. In all cases the pylorus was finally covered with an edge of the omentum.

All these dogs made good recoveries. A few were reopened, under ether anæsthesia, after varying periods of time, that we might observe, during active peristalsis, the action of the pylorus after operation. We were able to observe that when a peristaltic wave reached the region where the muscle wall had been cut, the contraction of these fibers, instead of causing a constriction in this region, caused an even wider gaping and an increased bulging of the mucosa. This intermittent pulling apart of the edges of the muscular wound by peristaltic contractions would seem to be the explanation of the fact, already clinically recognized, that after the Rammstedt operation, recurrence of stenosis is exceedingly rare (3). On autopsying these dogs, we found the cut edges of the muscular coats to be still gaping widely. In some cases the bulging mucosa was partially restrained by the overlying omental transplant, but there was no tendency toward stricture.

The objection is sometimes raised that the Rammstedt operation creates a dangerous weak spot in the gastro-intestinal wall. With this in view, we tested five of the dogs of this

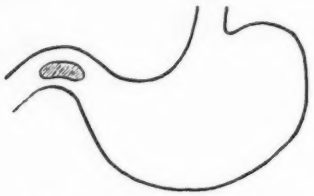

Fig. 4. Showing area of serous and muscular coats removed.

series as follows: At autopsy, the stomach and duodenum were removed in one piece. We then attached one end of the specimen to a gas tank, the other to a pressure gauge, and slowly inflated the specimen until rupture occurred. Rupture took place, in every case, not at the site of operation, but in the cardiac end of the stomach. The average pressure at rupture was 4¼ pounds per square inch. In two cases, further test was made by inflating only the pyloric end of the stomach and of the duodenum. In these cases, rupture did not occur until an average pressure of 11 pounds was reached, and still rupture did not take place at the site of operation but toward the stomach end of the specimen. Different investigators have reported intragastric pressures for the pyloric end of the stomach, varying from 25 to 162 centimeters of water (4, 5). In our tests, there was required to rupture this region of a stomach, a pressure equivalent to 748 centimeters of water. Thus it is seen that the areas subjected to the Rammstedt operation resisted successfully a pressure four and one-half times the maximum intragastric pressure reported.

To test further what factor the muscular coats constitute in the mechanical strength of the gastro-intestinal wall, we took segments of jejunum from a dog just killed and tested the degree of pressure required to rupture the segments under the following conditions: (1) with all coats intact; (2) with an incision made through the serous and muscular coats down to the submucosa; (3) with an incision made from inside the lumen through the mucosa and submucosa, leaving the muscle intact.

Each of these tests was repeated three times. We found that to rupture the intact wall of this region required an average pressure of 17 pounds. With an incision through the serous and muscular coats, it still required an average pressure of 17 pounds to cause rupture, and rupture did not always occur at the site of the incision. With the mucosa and submucosa cut, on the other hand, the average pressure at rupture was 10 pounds and rupture took place, in each case, at the site of incision.

It would thus seem that the resistance of the gastro-intestinal tract to a distending force is not appreciably decreased by cutting the muscular coats. Further, it is evident that there is a large factor of safety in the mucosa and submucosa alone for they were able to resist a pressure many times greater than the highest recorded by Cannon in his review of the literature on intragastric pressure (6).

CONCLUSIONS

1. A plastic flap operation or the Heineke-Mikulicz operation can secure, temporarily, a true enlargement of the pylorus, if the edges sutured are not turned in.

2. A normal pylorus, enlarged by any of the foregoing procedures, except the Rammstedt, tends to return toward its normal size. Whether a stenosed pylorus, thus operated upon, would return to its former stenosed condition or would retain a lumen of normal size, is still uncertain.

3. A plastic flap operation is unsatisfactory on account of requiring such extensive incisions into the lumen of the canal. It is also unsatisfactory on account of its tendency to retract and restore the divided pyloric sphincter.

4. The Rammstedt operation, or so-called "partial pyloroplasty," is, when conditions will permit, the most effective way of enlarging the pylorus. It has the advantage of being the simplest operation yet devised for this purpose and requires very little time under anæsthesia. The objections sometimes raised are:

1. Danger of hæmorrhage from the exposed submucosa;

2. Danger of peritonitis from puncture of the mucosa;

3. Recurrence of stenosis;

4. Danger of rupture at the "weak spot" created.

The first two of these dangers can be avoided if extreme care is used in performing the operation. The third has already been answered clinically (3). The fourth is shown to be unfounded on account of the large factor of strength residing in the submucosa.

We feel that the principle of the Rammstedt operation should not be confined entirely to cases of congenital stenosis but should be given more general application in the surgery of the pylorus.

NOTE.—Since the presentation of this paper there have been a number of additions to the literature on this subject. We would call attention especially to the following:

1. The report by Downes of a new and larger series of cases of use of the Rammstedt operation in congenital stenosis (7).

2. The report by Graham on the use of the Rammstedt operation in a case of pyloric stenosis in an adult (8).

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EXPERIMENTAL RECONSTRUCTION OF THE ŒSOPHAGUS BY GRANULATION TUBES

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VARIED attempts by widely different operative procedures have been made to solve the problem of reconstruction of the œsophagus after removal of segments of the organ. It has been realized for a long time that this is a basic problem in the surgery of œsophageal stenosis, for, whether the lesion is a benign or a carcinomatous stricture of the organ, the ideal would evidently be a restitution of the passage for food after operative removal or side-tracking of parts of the organ. The many experimental and occasional clinical efforts that have been made with this purpose in view have consisted either in partial or in total œsophagoplasty. It would lead too far afield to enter into the details of these methods. In brief, it may be said that the earliest plan was the formation of a skin tube fashioned from the skin of the anterior chest wall, to which the œsophagus above the stricture was attached superiorly, and the stomach below. Later developments consisted in the use of implants of loops of small or large intestine isolated in various ways, and, finally, tubes or flaps from the gastric wall were employed for this purpose.

Experimentally, these methods have been followed by occasional successes, and there are a few instances in which clinically, too, they have proved satisfactory. In the human being such procedures involve multiple operations over a period of many weeks or months, with the ever present likelihood of failure from complications, infection or gangrene of the isolated portion of the hollow viscus, etc. The technique of these œsophagoplasties is complicated, and the patient must necessarily be in good physical condition to withstand the several major operations. In fact, against the few successes that have been reported, there is the probability of a much larger proportion of unreported failures and an operative mortality that is not negligible.

If progress is to be made in this field it is essential, we believe, to separate the problem of œsophagoplasty into two distinct parts—a plan of operation adaptable for benign stenosis and one for cancer of the œsophagus. In the former, a considerable length of the

organ may be involved or the strictures may be multiple; the patient is usually young and in good physical condition, and the problem is one of sidetracking and not of removing the disease. In cancer of the œsophagus the patient is ordinarily old and debilitated by the disease; and the problem is one of replacement of relatively short segments of the organ. It is the latter problem that has engaged our attention in the experimental studies.

Before describing the experiments, brief reference should be made to the methods employed for re-establishment of the food channel in the two successful cases of its resection for cancer. In Torek's case no attempt at reconstruction was made. A rubber tube connected the stump of the œsophagus in the neck with a gastrostomy opening. Lilienthal employed a pedicled skin flap laid in place at the first operation, which consisted in the isolation of the neoplasm. After the removal of the growth, the skin flap was detached and the final result was a dermal channel to which the œsophageal ends became attached. The patient was a young individual in good physical condition; it is questionable if the procedure employed by Lilienthal will prove applicable to the cases of œsophageal cancer that are usually encountered. Indeed, it was from observations made during the time the brilliant series of operations were carried out in his case that we were led to perform our experimental work.

Repair of a wound of the œsophagus takes place by granulation tissue. Even a simple œsophagotomy with immediate suture will be followed by leakage until the incision in the organ is healed by granulation. An erroneous impression exists that anastomosis between the œsophagus and some other hollow viscus will be followed by repair as seen in the peritoneal cavity. The œsophagus has no serosal covering and the repair after operations upon the abdominal hollow organs depends primarily upon the existence of the serosal layer. Since repair of the œsophagus takes place by granulation, we determined to make use of this fact by establishing granulation tubes between the œsophagus stumps after resection of the organ. Our plan was to isolate a given section of the œsophagus and surround it by packings. At the next stage the isolated portion was to be resected and a rubber tube sutured in place. It was our impression that granulations would form about the tube and that the œsophageal epithelium would ultimately line the granulation tube.

The experiments comprise a series of operations performed on thirteen dogs, all under ether anæsthesia. The first operations were on the thoracic œsophagus. Attempts were made to approach the organ through the posterior mediastinum, but the pleura was invariably entered and death ensued from infection. The principles involved being the same and the technical difficulties fewer, operations on the cervical œsophagus were practiced in all the subsequent experiments. A striking fact was soon noted in these experiments on the cervical œsophagus: resection and rubber tube implantation in one stage was followed by death from infection. A suppurative process extended from the wound down the cellular planes of the neck into the mediastinum to involve both pleural cavities. The following experiment will illustrate this:

Experiment 1. Dog 1778. Weight, 25 pounds. *Operation, February 4, 1921.* Incision 4 inches, along anterior border of left sternomastoid muscle. Three inches of œsophagus were isolated from trachea and surrounding muscles, after retraction mesially of the great vessels and vagus nerve. One inch of œsophagus was resected, and a T-tube inserted and sutured into cut ends. The sternomastoid muscle, with a small arm of T-tube coming through it, was sutured, thus completing a muscular tunnel around the tube. The skin and fascia were closed. A typical Witzel gastrostomy was done.

February 5, 1921. Dog died. At autopsy the wound in the neck was found extensively infected, with pus bathing the muscles, trachea, and cut ends of the œsophagus; these ends, however, were held by the sutures to the tube. The infection extended down the cellular spaces of the neck into the posterior mediastinum, a purulent exudate covering the œsophagus, trachea, and prevertebral muscles. In addition there was a bilateral bronchopneumonia with a bilateral empyema, apparently a direct extension from the posterior mediastinum. Death was due to an overwhelming infection and sepsis.

On the other hand there have been no deaths from infection in the operation carried out in two stages, and we, therefore, regard this as the correct procedure. The technique

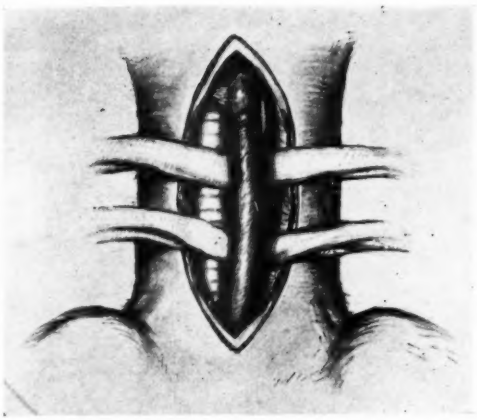


Fig. 1. End of first stage of operation. Œsophagus isolated from surrounding structures and packed off. In the actual operation, packings completely separate the organ from the trachea, great vessels, and muscles.

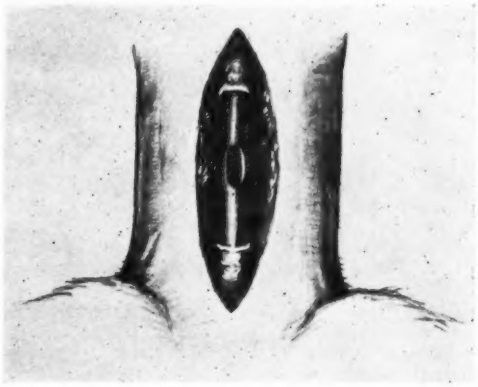


Fig. 2. End of second stage of operation. A portion of the œsophagus has been resected and replaced by a rubber tube, sewed into place above and below. The tube bridging the gap lies on a bed of granulation tissue.

is in brief as follows: A vertical incision is made to the left of the trachea and the œsophagus is exposed by retraction of the musculature and great vessels. The vagi are stripped free, the branches going into the segment to be resected being sacrificed. The desired portion of the œsophagus being thoroughly isolated, gauze packings are placed beneath it, the ends coming out of the wound. The latter is left wide open. At the second stage, one week later, the isolated portion of the œsophagus is elevated by traction on the packings and is divided obliquely above and below. The packings and the segment of œsophagus are then removed. A bed of granulation tissue is found to have formed beneath the packings. A soft rubber tube of the diameter of the œsophagus is securely sutured to the upper and lower ends of the organ by stitches passed transversely. The rubber tube has a lateral opening in order to feed the animal by a catheter passed through it into the stomach. When the tube becomes loose it is removed if it has not already been discharged from the wound.

By this time the external wound is largely closed by granulation tissue. An œsophageal fistula, or rather a fistula through the new formed granulation tube, persists but finally closes completely.

Three experiments illustrate the process of gradual reconstruction of the œsophagus by the granulation tube operation and their description indicates the results that have been obtained.

At the end of one week the ends of the resected œsophagus are partly attached to a gutter of granulation tissue. Upon microscopic examination there is beginning union between the cut ends of the œsophagus and the adjacent, partly formed granulation tube, the first stage of epithelial overgrowth extending from the œsophageal epithelium.

Experiment 2. Dog 1965. Weight 11 kilograms. *Operation, first stage, April 1, 1921.* An incision was made to the left of the trachea, from the lower margin of the sternomastoid muscle, upward along its anterior border, to the lower pole of the thyroid gland. The sternomastoid was retracted laterally; vessels identified, isolated and retracted. The œsophagus was found behind and a little to the left of the trachea. The left vagus nerve was carefully freed and retracted with the vessels, those branches to the œsophagus being sacrificed over the portion to be isolated. Two and one-half inches of œsophagus were isolated, surrounded by wet packings, and the wound left wide open. April 1 to April 8, dog was given normal diet by mouth.

Second stage, April 8. Weight, 10.5 kilograms. Granulations were red and healthy. The œsophagus was drawn out of the wound by means of the packings, and the packings were removed. The upper limit of the isolated area was cut across obliquely, with the dorsal wall of the organ longer than the ventral. A soft rubber tube was inserted into the upper cut

end, and the edges of the œsophagus sutured to it, taking four sutures, one behind, one in front, and two laterally. These sutures were passed transversely, and the knots were tied on the outside. With the upper junction of tube and cut œsophagus now secure, the œsophagus was cut across below and the lower end of the tube sutured here in a similar manner. About 2 inches of the œsophagus were removed. A window was cut into the tube for feeding purposes. The wound was left wide open.

April 11. Dog has pulled tube out. Œsophageal ends found and another tube inserted and sutured in place. Feedings through an opening in it are to be continued.

April 13. Tube has become loose again; left out. The lower end of the resected œsophagus can be seen glued down firmly to the surrounding granulation tissue. The upper end is not yet attached. Feedings to take place through the œsophageal fistula, through which a catheter can easily be passed into œsophagus, thence into the stomach.

April 15. Since yesterday the animal has been vomiting and breathing with difficulty. Death.

Autopsy. Infection of wound is limited to site of operation. The lower cut end is firmly glued down to the granulation tissue, and it appears that the posterior wall of the granulation tube which has replaced the œsophageal defect is lined with epithelium; its color is light pink and has a glistening appearance, resembling the normal œsophageal mucosa. The upper cut end is not yet glued down to the granulation tissue around it.

Death was due to operation which was performed during pregnancy.

Microscopic sections. Sections taken through the junction of the œsophageal cut ends and the granulation tube show an abrupt ending of the œsophageal wall as indicated on the surface by a dipping down and a heaping up of the epithelium. At this site there is a termination of the mucous glands and the muscularis ends by intertwining with the adjacent tissue. This latter is granulation tissue presenting the earlier stages of organization, with here and there islands and groups of polynuclear cells. Toward the free surface, vascularization is more marked; there are many new-formed blood vessels. The surface is covered in part by an extension of epithelium continuous with the œsophageal epithelium. This new-formed epithelium, however, presents the following differences from normal œsophageal epithelium: (1) there are no papillæ; (2) it is not as thick; (3) it stains more deeply; (4) flattened surface cells of normal œsophageal mucous membrane are not present; (5) nuclei of cells are round throughout; (6) very active mitoses are present; (7) there is some polynuclear infiltration.

Three weeks after operation the granulation tube is solidly formed, with some distortion because the external fistula through the same still persists. The union between the divided ends of the œsophagus and the granulation tube is firm, and there is a more extensive epithelial overgrowth arising from the œsophageal epithelium.

Experiment 3. Dog 1809. *Operation, first stage, February 11, 1921.* Typical Witzel gastrostomy done through a left upper rectus incision. Five centimeters of cervical œsophagus were isolated by the usual technique, as already described. Packings were placed around the œsophagus and wound left wide open.

February 11–18. A tube has been inserted into the gastrostomy opening for feedings only. Six ounces of milk were given twice a day and 7 ounces of water four times a day; moderate emaciation; animal in satisfactory condition except for diarrhœal stools.

Second stage, February 18. Resection of 3 centimeters of cervical œsophagus, with insertion of tube, in usual manner.

February 23. Tube has disappeared from wound; apparently in the stomach.

February 25. Condition of dog is satisfactory. Œsophageal fistula, about 2 centimeters long, is present. It seems that the defect has been bridged by granulation tissue. Dog to be given water by mouth.

March 1. Gastrostomy permitted to close. Rubber tube is in stomach, as shown by X-ray picture.

March 10. For the past 2 weeks the dog has been taking fluids by mouth. Most of it passes into the stomach, about 5 per cent escaping through the fistula in the neck. However, in a few minutes after swallowing food, it is regurgitated and escapes either through the fistula or is vomited.

Autopsy, March 11. There is no infection of the wound. Œsophageal defect is occupied by a thin, pinkish-white tube of tissue, loosely attached to the surrounding musculature and the trachea. There is gradual merging of normal œsophageal wall into the tissue occupying the defect. The interior appears to be lined by a smooth layer continuous with the œsophageal lining. The new-formed tube, showing no stenosis, is about 4 centimeters long and of about the same diameter as the œsophagus.

Microscopic section. The termination of the œsophagus is indicated on the surface by a slight dipping in of the epithelium; it is only marked definitely by the ending of the mucous glands in the depths. The musculature grades into the tissue that occupies the defect, well beyond the termination of the mucous glands, thinning out gradually, and becoming ultimately intertwined with the young fibrous tissue. The new-formed epithelium is similar in appearance to the old, being of about the same thickness. Papillæ are now well developed, the staining appearance is almost identical with that of the normal, and there is developed a subepithelial layer of tissue similar to the submucosa of the œsophagus, with very little leucocytic infiltration.

For the rest, the tissue occupying the defect is of about the same thickness as the œsophageal wall, and presents granulation tissue with considerable organization and many new-formed blood vessels. Sections from the upper and lower junction of the œsophagus with the new-formed tube, when taken together, present the evidence that there has been considerable growth of epithelium over the granulation tube. The middle portion, however, remains uncovered by epithelium and presents heaped-up masses of polynuclear cells on the free surface of the granulation tissue.

A dog kept for 7 months after œsophageal reconstruction by a granulation tube was in satisfactory physical condition during that period. After an early stage of disturbed deglutition accompanied by repeated regurgitation of food, this animal was able to swallow fluids and mush, but no large fragments of food. A stenosis of the œsophagus at the site of the granulation tube was noted, and it was apparent that this could have been dilated by bougies. However, dilatation was not practiced because we wished to learn if the stenosis would be progressive, and thus vitiate the operative procedure. The stenosis remained stationary and was found at autopsy to have resulted in the reduction of the normal circumference by about one-fourth. Furthermore, the autopsy showed that the œsophageal ends had been drawn toward each other, reducing the original defect of 5 centimeters by about one-half. The lining by overgrowing epithelium was complete and the new-formed "œsophageal tube" was of the same thickness and of greater resistance to hydrostatic pressure than the adjacent œsophageal wall.

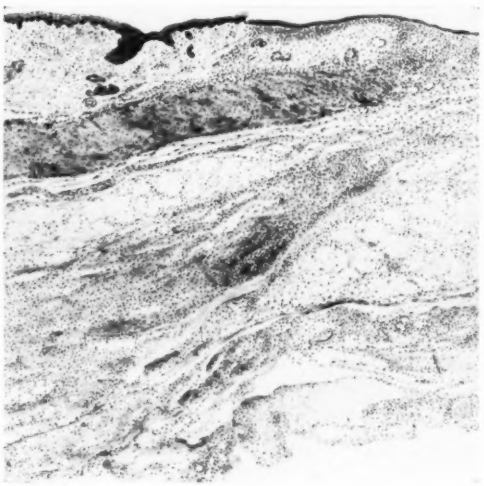


Fig. 3. Junction of normal œsophagus and replacement tissue at the end of one week. Low power drawing, showing abrupt ending of normal epithelium indicated by heaping of cells. The newly formed epithelium begins at this point.

Experiment 4. Dog 1929. Weight, 15 kilograms. *Operation, first stage, March 18, 1921.* Isolation of 7 centimeters of cervical œsophagus by usual technique.

Second stage, March 25. Resection of 5 centimeters of œsophagus. The tube was sutured in place in usual manner.

April 1. Weight, 14 kilograms. Animal in good condition; has been taking feedings of milk and glucose water well. Does not regurgitate.

April 8. Three days ago the tube became loose and slipped into the stomach. The œsophagus was probed but the tube could not be felt. An exploratory laparotomy did not reveal the tube in the stomach or intestines; evidently it has been passed per rectum.

April 15. Weight, 12 kilograms. For the past few days the dog has been vomiting his milk. The milk is kept down for a short time and is then regurgitated. Soup and finely divided pieces of meat were tried with no better result. The dog swallows the meat, but it is caught in an œsophageal dilatation, due probably to a lack of nervous innervation. In a few minutes the meat and soup are vomited, some coming through the fistula, but most of the mixture coming out of the mouth. After repeated swallowings and acts of vomiting, the food remains in the stomach. Holding the animal up on his hind legs does not seem to aid in keeping the food down. Feedings through the fistula are to be discontinued; dog is to get meat, soup, milk and glucose water by mouth only.

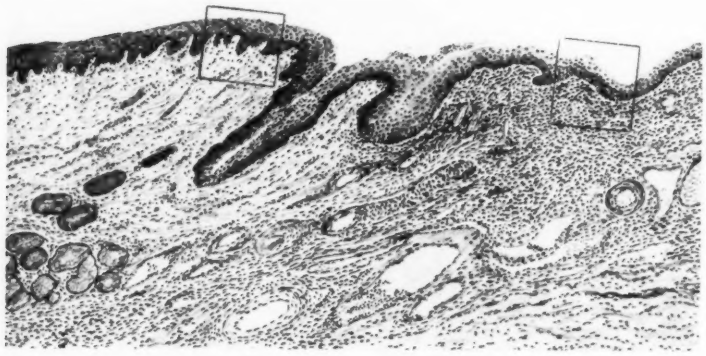
April 22. Weight, 10.75 kilograms. Dog is in fair condition, although he still regurgitates food. A No. 20 bougie, when passed, meets an obstruction at the region of the fistula and passes it readily.

May 11. The general condition of the dog is good. He is very active, and runs around normally. Fluids are kept down better. *Œsophagoscopy* by Doctor Yankauer shows a stenosis at the site of the new-formed tube.

May 27. Weight, 10.75 kilograms. The fistula is closed. A No. 20 bougie meets an obstruction at this region but passes it easily. The stricture is apparently being gradually dilated by the passage of food.

October 17. Weight, 9.5 kilograms. During the summer the condition of the dog has been good. Regurgitation of food has gradually become less, although it still occurs.

Chloroformed.



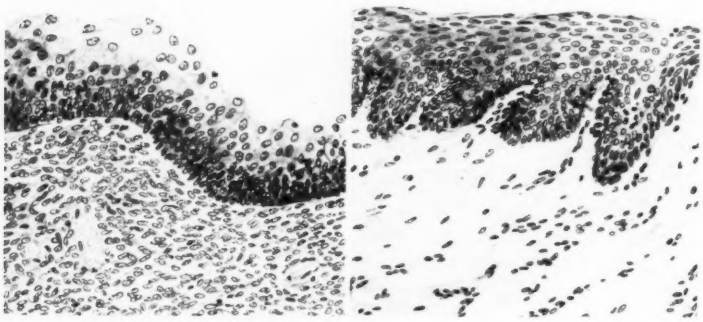


Fig. 4 (above). Medium power drawing of junction at the end of one week, showing ending of mucous glands and the differences between the normal and newly formed epithelium.

Fig. 5 (below, left). High power drawing of normal œsophageal epithelium at site of first square above.

Fig. 6 (below, right). High power drawing of newly formed epithelium at site of second square. There are no papillæ, no flattened cells at surface. The nuclei are round throughout, active mitosis and leucocytic infiltration in submucosa.

Autopsy. In the region of the operation, thin fibrous tissue loosely binds the œsophagus to the surrounding structures. There is considerable dilatation of the œsophagus above the reconstructed tube; the latter is narrowed by about one-fourth the lumen of the normal œsophagus. The new-formed portion is 4 to 5 centimeters in the fresh state as represented by whitish tissue different in color from the normal pinkish œsophagus. It is of the same thickness as the normal œsophagus, and when viewed from the inside a smooth, glistening lining completely covers the surface, bridging the area from normal œsophagus above to normal œsophagus below. Very fine blood vessels may be seen coursing from normal mucosa to the regenerated mucosa.

With the specimen removed, active peristaltic waves starting from the dilated portion proceed across the reconstructed tube to normal œsophagus below; active retroperistalsis passes in similar fashion. At times it seems as if the peristaltic wave skips the new-formed tissue; at other times a definite contraction through it is observed. This peristaltic action lasted for over an hour, in the isolated specimen, without immersing it in any physiological fluid medium.

Microscopic. Sections taken through the area of reconstruction show, on the surface, epithelium which has regenerated completely, there being no tissue left uncovered by epithelium. The new epithelium is similar to normal epithelium with perhaps the slight difference of more highly developed papillæ. The defect is occupied by fine-meshed fibrous tissue, which toward the surface resembles submucosa, and in the depths is a connective tissue rich in blood vessels. The tissue comprising the defect is as thick as normal œsophagus above and below.

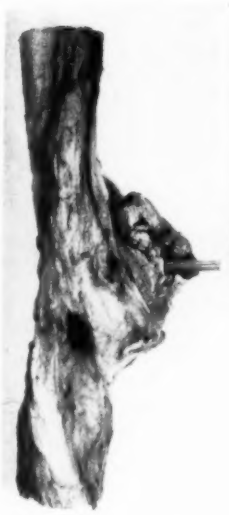


Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. Granulation tube occupying defect. Three weeks after operation. Newly formed tube is of a lighter color than normal œsophagus. Stylet indicates fistula leading into neck.

Fig. 8. Same as Figure 7, opened up, showing granulation tissue bridging gap between normal œsophagus above and below.

Fig. 9. Photomicrograph of junction of normal œsophagus and newly formed tissue, three weeks after operation. Section indicates ending of mucous glands. Musculature intertwines with the newly formed fibrous tissue. Regenerated epithelium very similar to the normal, with well developed papillæ.

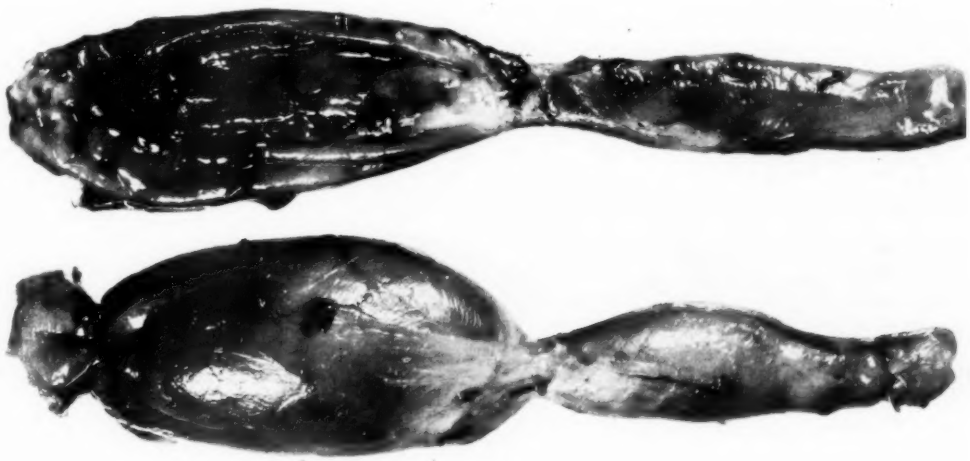


Fig. 10 (above). Specimen of œsophagus and newly formed tube 7 months after operation. Stricture narrowing lumen by one-fourth normal diameter is shown, with dilatation above.

Fig. 11. Same specimen filled with water, bringing out in contrast site of stricture which corresponds to that of the former œsophageal fistula.

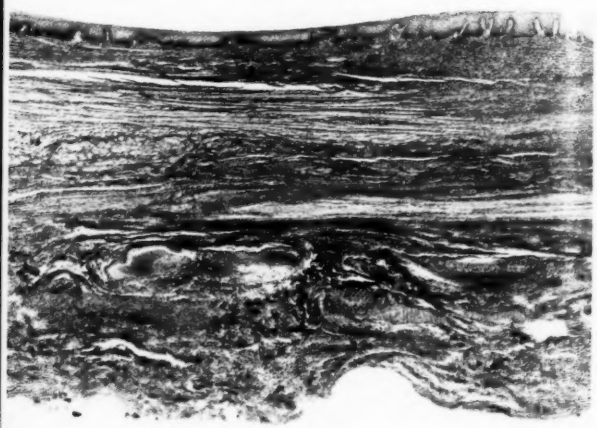


Fig. 12 (at left). Specimen opened up. Contraction of musculature; reconstructed area different in color from that of adjacent œsophageal wall.

Fig. 13. Photomicrograph showing the reconstructed area continuous with normal œsophagus. The newly formed epithelium is similar to normal epithelium. Junction point is indicated by ending and intertwining of muscle bundles. The thickness of the newly formed œsophageal wall is the same as that of the adjacent œsophagus.

As far as the actual reconstruction of the œsophagus by a granulation tube is concerned, we believe the difficulty would not be as great in the human being as in the animal experiments. In the latter there was always the problem of controlling the animal and of retaining the implanted tube for the desired period. It proved impossible to prevent the swallowing of all sorts of septic material even in the presence of a gastrostomy, dressings could not be kept in place, etc. The technique, as we believe it to be applicable to the human being, may be described as follows: Following gastrostomy, the first stage of the operation would be the exposure of the cancer of the thoracic œsophagus through the posterior mediastinum by the extrapleural approach as described by Lilienthal. An operable condition being found, the portion of the œsophagus bearing the tumor is isolated from surrounding structures, including the vagi, the branches entering the neoplasm being sacrificed. The isolated segment is surrounded by a sling of rubber dam on the outside of which packings are placed. The wound is left open in large part or completely. Superficial packings are changed when necessary, but deep packings are left undisturbed unless there is evidence of infection in the wound. It may be mentioned in passing that mediastinal suppuration can be present without clinical evidence, for in a case in the experience of one of us (H. N.) in which the above described first stage operation was done, a walled-off collection of pus in the mediastinum was unexpectedly encountered at the second stage operation performed one week after the isolation of a cancer of the thoracic œsophagus. At the second stage operation, the section of the œsophagus would be drawn toward the surface of the wound by traction on the rubber dam. The œsophagus would be divided above and below the neoplasm, not straight across but obliquely with the idea of reducing stenosis of the divided ends. A soft rubber tube would be chosen with a diameter of the filled œsophagus. One end of a long strand of silk would be fastened to the tube, the other end being brought out of the mouth and strapped to the cheek. The rubber tube would extend about 4 centimeters up and down into the œsophageal ends, and fixed to the wall of the œsophagus by sutures of

chromic gut passed transversely to œsophageal axis, with knots tied on the outside. Packings would be loosely placed about the rubber tube and the wound would either be partly sutured or left wide open.

This technique of rubber tube implantation would appear to be applicable only to œsophageal resection below the level of the arch of the aorta, and would probably have to be modified for tumors opposite or directly above the arch. In a patient operated upon by one of us (H. N.) in whom the neoplasm lay directly above the arch, the tumor-bearing portion of the œsophagus was isolated and the œsophagus stripped free up to the root of the neck. It was then divided below the neoplasm and a rubber tube sutured in place. The wound was packed with gauze and left open. The patient died of hæmorrhage from an intercostal artery 9 days after the first stage operation. It was planned at the second stage to expose the œsophagus in the neck, draw the tumor-bearing portion into the cervical wound, divide the œsophagus above the growth here, draw rubber tube into neck and suture it to the upper œsophageal stump.

Clinical experience will, of course, be necessary to determine if results similar to those noted in the animal experiments can be obtained, and whether a one- or two-stage operation will be required. From our studies, however, we believe it justifiable to advocate the reconstruction of short œsophageal defects such as those encountered in resection for cancer, by the granulation tube method we have devised.

SUMMARY

A simple experimental method has been devised in which a granulation tube is employed for the reconstruction of the œsophagus after its resection.

Fatal mediastinal infection follows its attempt in one stage.

The two-stage operation is successful. In the first stage the section of œsophagus to be removed is isolated and in the second stage it is resected and a rubber tube is implanted.

A granulation tube forms with epithelial overgrowth from the œsophageal ends beginning in one week and becoming extensive at the end of 3 weeks.

The longest period of observation was 7 months after operation. In this case the new-formed tube was well developed and completely lined by œsophageal epithelium. A partial stenosis appeared soon after operation but was not progressive.

The method is advocated as applicable for reconstruction of the œsophagus after resection for cancer.

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TOTAL REMOVAL OF THE SCAPULA FOR PRIMARY GIANT-CELL SARCOMA

By BYRON B. DAVIS, A.B., M.D., F.A.C.S., Omaha, Nebraska

COMPLETE excision of the scapula was first done in 1855, by Langenbeck. The chief indication for the operation is sarcoma, and, since this neoplasm rarely occurs primarily in the scapula, the number of excisions has been few. As regards the rare incidence of sarcoma of the scapula, the figures of Coley are illuminating. In 1910, he reported 251 cases of bone sarcoma that had come under his observation, distributed as follows:

Femur	117
Humerus	54
Tibia	40
Fibula	8
Radius	12
Ulna	7
Clavicle	11
Metacarpal	2

His list does not contain a single instance of sarcoma of the scapula. John B. Murphy, in 1915, showed a case in his clinic of sarcoma of the scapula, for which he did a total excision; and at the time he gave the distribution of 797 cases of bone sarcoma, as follows:

Head	23
Jaw	227
Thorax	20
Scapula	23
Clavicle	3
Humerus	90
Radius	90
Ulna	15
Hand	19
Ilium	17
Sacrum	6
Femur	160
Tibia	100
Fibula	25
Foot	29

This table gives only 23 cases of sarcoma of the scapula in 797 cases of bone sarcoma, making its incidence a little less than three-tenths of one per cent.

For his inaugural address as president of the American Surgical Society, in 1909, Nancrede chose for his subject, "End-Results after Total Excision of the Scapula for Sarcoma." All the cases he could find records of, at this time, in the world's literature, were 65, and of the whole number, only 1 was nearly certainly cured. In the face of this appalling mortality, Nancrede concluded that, in the future, he would recommend intercostohumeral amputation in preference to total removal of the scapula.

Fowler, in his *Treatise on Surgery*, says that in a fortunately early case of sarcoma of the scapula, there is a possibility of a successful excision "but the instances must be few and far between in which such a course would not be followed by recurrence."

September 5, 1921, Mrs. F. C., age 27, consulted me for an enlargement of the left shoulder blade. She gave the following history:

She has had measles, small pox, and whooping cough. Otherwise she has always been well except for her present trouble. September 9, 1919, while trying to raise herself upon a log, her left hand slipped, and she felt a sharp pain in the left shoulder. She is certain that she did not strike her shoulder against any object. For about a month after this occurrence, when exercising her arm, she experienced pain over the left scapula. At the end of a month this pain disappeared and she noticed nothing more until August, 1920, when, after swimming for a long time, she felt some aching in the region of the left scapula. She was married in October, 1920, and, after this, when doing housework, she noticed, at times, pain over the scapula.

While going down the cellar stairs, December 22, 1920, she tripped and threw out the left arm to catch herself, and there was a sudden sharp pain in her left shoulder blade. The pain lasted about 5 minutes. The pain immediately subsided, and she forgot all about it until 6 days later, while visiting in Creston, Iowa, she noticed in the mirror, while raising her left arm, an oval swelling about the position of the body of the scapula. This swelling she described as about 2 inches long and 1½ inches wide. She consulted a doctor, who told her she had a fracture of the left scapula, but gave her no treatment. During the next few weeks, the swelling extended more posteriorly. From this time on she had occasional pain when she moved her arm vigorously.

At Easter, in 1921, she burned her finger and jerked her arm away, and there was severe pain over the scapula for a few minutes and soon it

Fig. 1. Roentgenogram showing tumor of the scapula.

Fig. 2. Gross specimen of tumor of the scapula.

became more swollen. She consulted a physician in Lincoln, Nebraska, who told her to paint iodine over the swelling. Under this treatment she says the mass diminished in size considerably, but in about a month she found it was growing again.

In June, 1921, a roentgenogram was taken and she was again told she had a fracture of the scapula. Since Easter there has been pain over the scapula whenever she uses her arm.

In August, 1921, she consulted a surgeon, another X-ray was taken, and the diagnosis of sarcoma of the scapula was made for the first time.

My physical findings at this time were as follows: The body of the scapula is very much enlarged and rounded, making it very prominent, the mass being at least 3 inches, possibly 4, in thickness. The skin is movable over the mass, and the scapula is freely movable over the chest wall. The mass is only fairly firm in consistency and crackles slightly when pressed. The range of motion of the arm is only slightly limited. There are a few superficial dilated veins, coursing over the tumor. The X-ray indicated a sarcoma of the body extending up along the anterior border to, but apparently not including, the glenoid cavity. Clinical diagnosis: sarcoma of the body of the left scapula. Removal of the scapula was advised and she entered Immanuel Hospital, September 9, 1921.

Operation, September 12, 1921. Drs. Herbert Davis, O. E. Olson, and E. K. Eskildsen assisted, and Dr. J. S. McAvin gave gas and ether. An incision was made from the inner border of the axilla outward along the course of the coracobrachialis muscle. The axilla was opened, its anterior fold retracted forward, and the tip of the coracoid process reached with the finger. The pectoralis minor muscle was hooked up and cut with scissors. Next, the coracobrachialis was pulled up with the retractor and cut, after which the short head of the biceps was raised on the retractor and cut, all of them at a considerable distance from their attachment to the coracoid process. The subscapular artery and vein were made easily accessible and were ligated doubly and cut between, and the axillary wound packed with gauze.

To make the field of operation accessible for the next step the patient was turned on her right side. An incision was made from the superior angle of the scapula, along the vertebral border to the lower

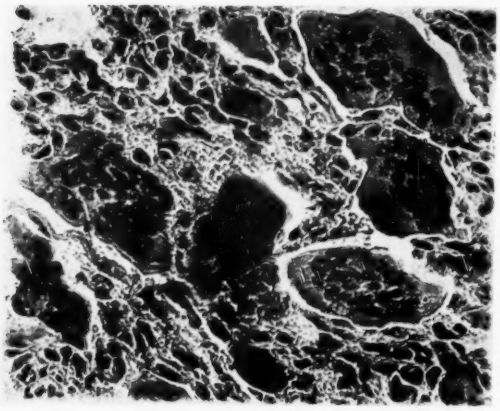

Fig. 3. Photomicrograph of section of tumor removed.

angle. Another incision was carried from the tip of the acromion process along the spine of the scapula until it met the first incision. The skin flaps thus formed were dissected up sufficiently to uncover an area corresponding to the scapula. The trapezius muscle was now cut away from its attachment to the scapula at a short distance from the bone. Next, the minor and major rhomboids were severed, also at a little distance from the vertebral border of the bone. The latissimus dorsi was found to be attached to the lower angle by a few fibers, which were divided, and following up the anterior border, the teres major and minor muscles were both cut. The finger was next inserted underneath the flat serratus magnus and the entire muscle was cut just before it passed behind the external border of the subscapular muscle.

The lower angle of the scapula was then raised from the thoracic wall and everything loosened from behind; then, passing upward, the levator anguli scapulæ and the omohyoid muscles were cut. At this point both the descending branch of the transversus colli and the transverse scapular arteries were cut and tied. The deltoid was now separated from all its scapular attachments and the acromion process was disarticulated from the clavicle. The humeroscapular joint was then opened, and the humerus separated from the glenoid cavity. The long head of the biceps and the long head of the triceps were divided, after which the coracoid process was freed from what attachments remained.

After tying all the bleeding points a running suture of catgut was used to gather a mass of muscles about the head of the humerus in such a way as to form a muscular pocket. The skin wounds were closed with dermal stitch and a small rubber drainage tube was inserted at the meeting point of the two skin incisions.

The patient was turned on her back and the axillary wound closed, leaving a small rubber drainage tube. The wound was dressed, the elbow being kept abducted somewhat away from the chest wall.

There was some shock, from which patient had fully rallied within 6 hours. The muscles were all divided almost an inch away from their attachments to the scapula. As the operation proceeded, it was remarked how little trouble was experienced from hæmorrhage. Sir W. Watson Cheyne was the first to recommend preliminary ligation of the subscapular artery, and it seems an excellent procedure. The most difficult part of the operation as usually done is separation of the coracoid process; by dividing the three muscles attached to this process through the axillary wound the operation is much simplified.

September 18, the patient was able to brush her teeth, using the left hand to hold the tooth brush, and she sat up for the first time.

September 19. Sat up 2 hours during the forenoon and is feeling fine.

September 20. Combed and arranged her hair. She was encouraged to use the hand in every way possible, several times daily.

Discharged from hospital and recommended to exercise the arm as much as possible without discomfort.

The following statement was made by her in a letter written me November 30, 1921: "In regard to my arm I find it is still gaining in strength. I can take care of general housework, such as making beds, sweeping, dusting, ironing, sewing, dishwashing, etc. I find my hair-dressing is improving too. It is not such an effort for me to comb my hair now and the result is also much better. The grip of the left hand is as good as the right. People have told me here they had not noticed by appearance, or action that I did not have full use of my arm."

Pathological examination by J. Jay Keegan, M.D., from the pathological department of the University of Nebraska Medical College:

"Pathological examination of the tumor of the scapula of Mrs. C. showed a rounded tumor mass involving almost all of the axillary border below the glenoid fossa, the inferior angle, and extending along the vertebral border a distance of 1½ inches. The weight of the entire specimen including muscles was 805 grams, with muscles removed 425 grams. The tumor mass measured 4 inches in length, 3½ inches in width and 3 inches in depth, being flattened against the chest wall. Its consistency was soft, almost fluctuant in the center, with a few spicules of bone palpable. It was enclosed in a definite capsule except at the inferior angle and below the glenoid fossa, where reddish granular tumor tissues appeared.

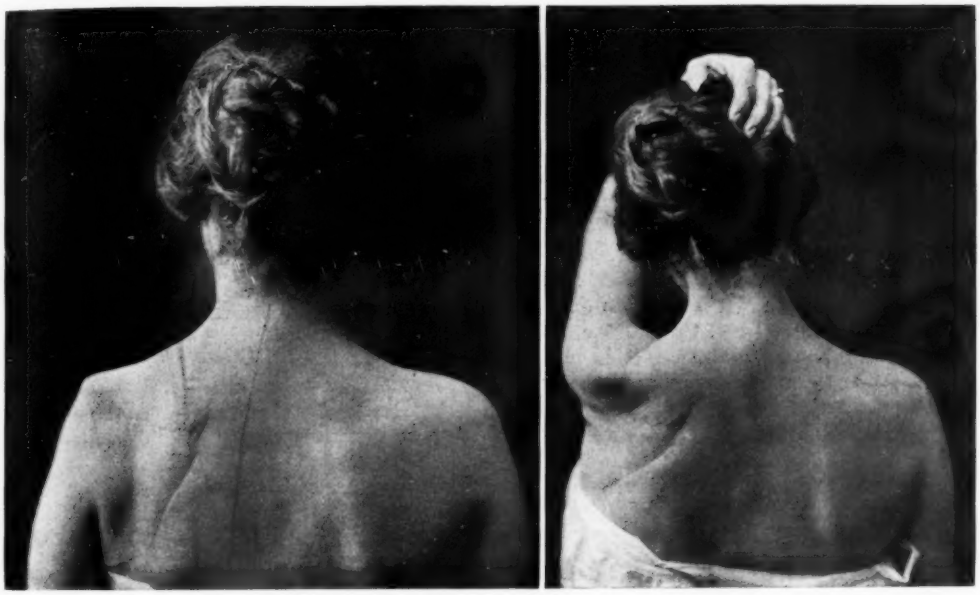

Fig. 4. Photograph of patient after operation showing scar and patient's ability to raise hand above head.

"Microscopic examination of one of these granular areas showed a very characteristic giant-cell sarcoma. Three types of cells were present: a stroma of elongated spindle cells resembling fibrous tissue, this enclosing areas of larger fusiform cells and multinuclear giant cells. The operative removal was sufficiently wide so that no tumor tissue was incised. This type of tumor is considered relatively non-malignant as it rarely metastasizes and complete removal usually results in a cure. The only questionable areas were two places where the tumor appeared to have broken through the capsule."

As far as it has been possible to ascertain in a rather extensive search of the literature, this is the first case of unquestioned giant-cell sarcoma of the scapula yet reported. I am free to admit that before the case was operated upon, it was not certain what type of sarcoma we had to deal with, though, from the history and the rather slow development, it was felt there was good ground for considering it a mildly malignant growth and entertaining a lively hope that it was a giant-cell tumor.

It is, I believe, to Nélaton, that we are indebted for first fully establishing the benign course of giant-cell sarcoma, and the good results of conservative treatment. But the careful observations of Bloodgood andthe fearlessness with which he has put the conservative treatment of this class of cases on a workable basis have done much to standardize our knowledge. The last report of his I have been able to obtain gives 47 cases of benign giant-cell tumors in which the ordinary features of malignancy were absent.

Coley has been working on the same line, but in his 40 cases of giant-cell sarcoma, the diagnosis being confirmed by leading pathologists, 8 have died of metastases.

The gross appearance of these tumors is variously described as "reddish jelly-like tumor masses resembling granulation tissue," "rather soft and, on section, resembles splenic tissue, or even currant jelly." They pulsate and even after they have absorbed the bone and broken through in places, the true giant-cell tumor shows no disposition to infiltrate the soft tissues.

Histologically this species of sarcoma consists of giant-cells so numerous and so uniformly distributed as to give a characteristic appearance under the microscope.

These giant multinuclear cells are not the sole cellular elements of which the tumor consists. There are also round or spindle cells grouped around the giant cells, which vary in size and shape. They are usually round or oval, sometimes having a uniform margin and sometimes being very much broken in outline, with protoplasmic masses extending out from the main body of the cell.

Several surgeons and pathologists, notably Bloodgood, Coley, and Platou take the position that these giant-cell tumors are always permanently benign and that it is entirely justifiable to treat them conservatively by curetting out the soft tumor tissue mass, or doing a conservative resection of the bone, or, if very extensive, an amputation may rarely be required. Others are not so certain. Ashhurst seems to take the ground that, although the real giant-cell sarcoma does not metastasize, it may occasionally undergo sarcomatous change, when it begins to grow rapidly and recurrence is usual. Even Ewing, who holds to the benign character of giant-cell sarcoma, admits that as the spindle cells of the stroma become more active and abundant, the giant cells diminish, the resemblance to granulation tissue is less in evidence, and the tumor comes more and more to resemble a spindle-cell sarcoma. When this point is reached, local recurrence, destruction of bone, and infiltration of soft tissue occur, but Ewing has never known such growths to metastasize.

The exact line of separation between the entirely benign giant-cell tumor and the sarcoma with a superabundance of giant cells, which does infiltrate, which does form metastases, seems yet somewhat imaginary, and there seems to be some danger of ultra-conservative treatment being carried too far.

STREPTOCOCCUS SCROTAL AND PENILE GANGRENE[1]

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ACUTE fulminating gangrene of the scrotum and penis is a disease characterized by an abrupt, spontaneous onset, a rapidly ensuing inflammation with marked œdema, and subsequent necrosis of the superficial tissues of the genitals. The condition is usually accompanied by generalized sepsis and prostration. In private practice the disease is rarely, if ever, encountered. Indeed it is rarely seen except among patients of the large city hospitals. Physical debility associated with a variable degree of bodily filth is more frequent in patients of these institutions and may, in a measure, bear relationship to the occurrence of the disease. During the past 6 months, we have observed clinically and studied bacteriologically 5 cases admitted to the Urological Service of Bellevue Hospital. These investigations revealed a streptococcus hæmolyticus in each instance as the probable causative agent. This finding substantiated by the clinical picture leads us to believe that the disease is closely akin to the syndrome of erysipelas.

CLINICAL FINDINGS

A spontaneous, extensive tumefaction of the scrotum and penis occurs. Frequently these may become three, four, and even five times normal size. The involved parts are exquisitely painful, hot, and the skin is tense, shining, and sensitive. Redness may extend to the lower abdominal wall. There is, however, no sharp line of demarcation. Considerable œdema soon develops. Within the next 36 to 72 hours the glazed skin becomes a dull red, a superficial watery exudate appears, and in the more dependent portions there is the brownish or greenish tinge of early gangrene. This gangrenous process may often begin in several places simultaneously, especially on the lower parts of the scrotum or on the pre-

[1] From the Urological Service, Bellevue Hospital.

puce and skin immediately behind. It spreads rapidly toward the groin rather than toward the perineum, a characteristic distinguishing it from the gangrene of so-called urinary extravasation.

Soon, as in other types of gangrene, a line of demarcation is established beyond which the process will not extend. The gangrenous areas, if multiple, coalesce to form one gangrenous mass. Two of our cases (4, 5) are unusual in that the infection extended posteriorly to both ischiorectal fossæ with a necrosis of all the superficial perineal tissues. The patient is likely to die before the gangrene extends upward beyond the pubic region though it may reach the umbilicus. Involvement of the penis does not extend beneath the sheath of the corpora cavernosa. Involvement of the testicles and cord is limited by the sheath and tunica vaginalis. Sloughing of the testicle does not occur. In two of our series (1, 4) there was partial sloughing of the tunica vaginalis. The skin of the thighs is singularly exempt from involvement. In neglected cases, during the 4 or 5 days succeeding onset, the definitely demarcated, sloughing, gangrenous mass, emitting the characteristic stench of decaying flesh, separates. Removal of the scrotal tissues by necrosis or the knife leaves the testicles dangling unprotected between the thighs. Some have noted crepitation of the tissues; we have not. The condition is in no sense a venereal disease and is accompanied by no urinary disturbances.

SYMPTOMS

Many writers have remarked of the sudden onset of systemic symptoms—chills, fever, nausea, vomiting, prostration, and delirium. While some of our patients were septic, in the others the contrast between the excellent general condition and the intense local reaction was most striking. An acute fulminating onset—designated "explosion" by Fournier—with a rapidly ensuing moist gangrene of the involved tissues, appearing spontaneously, has characterized our series of cases. It was not at the onset that our patients manifested symptoms of toxæmia but rather after the gangrenous process was evident—an absorption intoxication.

ETIOLOGY

Of paramount interest is the etiology and pathology of the disease. According to Whiting (1), the most probable predisposing factors to scrotal gangrene are (1) the laxity of the cellular tissue which permits marked infiltration and (2) the looseness of the skin which diminishes resistance to infection. Age apparently is no factor, the youngest case on record being 2 years old (Marcy); one of our patients was 71. Trauma has been considered by some but an analysis of case records shows it to be singularly lacking in most instances. It is possible that concomitant lesions as urethritis, bubo, phimosis, etc., may afford a portal of entry. One patient told of an intense penile itching, for relief of which he resorted to scratching with the fingernails. Soon thereafter, a malignant infection appeared, but it is reasonable to suppose the itching was an early manifestation of a highly virulent infection not yet grossly evident. It is conceivable that the organisms may be introduced by clothing friction.

BACTERIOLOGY

Clinically and pathologically the condition seems to be a cellulitis, the onset, manner of extension, the red, painful, hot, and œdematous nature of the lesion being characteristic of such a type infection. Most observers have felt that there must be a definite causative organism and consequently a number of bacteria have been accused as the etiological agent. Thus, the Klebs-Loeffler bacillus, the spirillum of Vincent's angina, an aerobic diplococcus, various anaerobic organisms, a pseudodiphtheria bacillus, bacillus aerobus septicus, bacillus aerogenes capsulatus, and the streptococcus have been arraigned. More recently a pseudo-Ducrey bacillus has been included. The wide variety of organisms mentioned is evidence of their undetermined relationship to the disease.

In all of our cases recently studied, direct smears were made through the cauterized skin surface before incision and all showed a long chain variety of streptococcus. In four

Fig. 1. Case 1. Partial denudation of testicles and penis, 5 days after operation.

of these cases the material so obtained was plated on blood agar and after 48 hours pure cultures of streptococcus hæmolyticus were obtained. In view of the constancy with which we encountered the organism and the association of erysipelas of the face and arm with the scrotal gangrene in one of our patients (the erysipelas succeeding the scrotal condition by 4 days with an admissible history of transmission to and inoculation of the face by the fingernails after having scratched the scrotal tissues) it seems entirely reasonable to suspect that this so-called idiopathic gangrene may be a cellulitis of the superficial tissues not unlike erysipelas.[1] A search of the literature reveals but 6 cases of scrotal erysipelas, the onset and course of the disease coinciding well with that of "idiopathic" gangrene,[2] all being followed by necrosis and sloughing of the involved parts. Finch (3) has reported an instance of scrotal erysipelas followed by gangrene as a result of infection produced in tapping a hydrocele. Such a sloughing gangrenous erysipelas of the penile skin occurred in the wards of the famous surgeon Nélaton following a trifling incision of the frenum. It seems reasonable, therefore, to consider these cases as intimately allied to erysipelas, if not typically the condition itself, the presence of the hæmolytic streptococcus of the streptococcus longus type being corroborative.

[1] Fehleisen (2) described an organism called by him the streptococcus erysipelatis believing the disease erysipelas to be a specific infection of this strain. At present, bacteriologists are not prone to accept this view. Most believe the disease may be produced by any of the streptococcus longus hæmolyticus variety, there being no streptococcus of erysipelas *per se*.

[2] So called by Randall, Alexander. J. Urol., 1921, iv, 219.

PATHOLOGY

Grossly, the penis and scrotum appear as previously described. On incision, the subcutaneous tissues are yellowish or brownish green color, depending upon the degree of necrosis, and are bathed in œdematous exudate, great quantities of fluid escaping as the tissue is sectioned. These tissues are somewhat friable and are easily torn or separated by finger dissection. It is noteworthy that the vessels everywhere show thrombosis, bleeding being encountered only when tissue relatively free from involvement is cut. The generalized thrombosis explains the gangrenous changes. Pus pockets are not uncommon beneath the penile skin, lying upon the sheath of the corpora cavernosa. In some instances, this burrowed up under the lower abdominal skin, this being tougher and more resistant to the invading process. In one instance, pus burrowed along the spermatic cord into the inguinal canal.

Microscopic examination of involved tissue reveals only areas of partial and complete necrosis. Polymorphonuclear infiltration is abundant throughout. The vessels show thrombosis.

DIFFERENTIAL DIAGNOSIS

The condition which most closely simulates this form of scrotal gangrene is that called urinary extravasation, a gangrene of scrotum and perineum secondary to periurethral suppuration and usually associated with stricture. If is it borne in mind that the urethral sclerosis does not necessarily obstruct the passage of instruments of moderate size, careful history and local examination will usually reveal the urethral origin of the extravasation while operation always discloses it. The absence of urinary symptoms, the free passage of urethral instruments to the bladder, and the sudden onset without cause should rule out extrava-

Fig. 2. Case 1. Appearance 5 weeks after operation. There is some distortion of the penis which, however, is not evident in the picture.

sation. Acute periurethral abscess scarcely simulates scrotal gangrene, for it is not associated with gangrene. Passive œdema of the scrotum due to nephritis, cardiac insufficiency, hepatic cirrhosis, Asiatic cholera, smallpox, chronic alcoholism, diabetes, etc., may well be mistaken for streptococcus gangrene at first glance for the two conditions occur in patients of a similar type and the œdema may simulate the gangrenous process quite closely in its rapid onset and great swelling. We know of a case of œdema that was operated upon under the mistaken diagnosis of urinary extravasation. The gangrene of diabetes especially should be considered because of the striking clinical similarity of the two conditions.

PROGNOSIS

Whiting (1) collected 93 reported cases from the literature, of which number 23 died, a mortality of 23.5 per cent. Coenen and Przedborski (4) found 145 cases among which there was a mortality of 22.1 per cent. Of the 5 cases here reported, 1 died. A mortality of 20 to 25 per cent is therefore apparently to be expected. The prognosis seems to depend upon the severity of the toxæmia. The urine of two of our patients was studied several times, but showed no evidence of toxic albuminuria. In no case was sugar found.

Fig. 3. Case 3, 5 days after excision of involved skin areas. Marked induration of the scrotal septum is to be noted, a portion of this structure having been removed.

Emery (5) speaks of the "mode of termination of the disease by a cure" and in our series all recovered readily save one who developed metastatic erysipelas.

TREATMENT

The treatment is surgical. A review of the earlier therapy is most interesting. Apparently the entire pharmacopeal armamentarium was utilized: glycerin, belladonna, bichloride of mercury, various dusting powders, etc., were administered interchangeably. Once castration was the recognized procedure, a regeneration of the scrotal tissues being deemed impossible. So common was this procedure that a physician near Boston reported a case under the title "Gangrene of the Scrotum in Which the Testicles Were Not Removed." We now recognize that the testicles and their enveloping sheaths should be left intact. Some have questioned the wisdom of free and early incision. Such incision has been our routine procedure, thus permitting proper surgical drainage. If there is extensive involvement, whole masses of scrotal skin have been excised. If there is involvement of the penile skin, it too is removed as far back and extensively as seems indicated, since we are aware of the surprising regenerative powers of the skin of these parts. Anæsthesia is by no means always necessary, much of the involved tissue being insensitive. Hot potassium permanganate 1:500 applied continuously serves as

Fig. 4. Case 4. Picture taken 2 days after operation. This patient developed erysipelas of the face and right arm 3 days later. There was marked extension along the penis. Later the lower abdominal wall became gangrenous.

Fig. 5. Case 5. Three days after operation. The most unusual complication of extension to the buttocks with subsequent sloughing of the superficial perineal tissues is noteworthy.

an antiseptic and deodorant. We employ it both as a dressing and irrigant.

As soon as the patient has recuperated sufficiently from the excision operation, he is given a daily bath for an hour in a tub of hot water. This has proven most beneficial, serving admirably to cleanse the wound thoroughly. Once the slough is removed, the rapidity with which the granulation tissue forms is astounding. Various plastic operations have been suggested, but if one will adhere to the rule of keeping the testicles well against the perineum, the scrotal tissue will be found to regenerate over them and operations will rarely be necessary. No plastic operations have thus far been necessary in our series. If there is much cicatrix formed about the base of the penis, there is of course danger of chronic œdema of the glans. A moderate œdema was noted in one case but has called for no treatment.

CASE REPORTS

Case 1. W. B., ticket agent, age 29 years, was admitted to the Urological Service, Bellevue Hospital, March 14, 1921, complaining of swelling and pain in the penis and scrotum. Duration 2 days. Onset sudden and rapidly progressive accompanied by chills, fever, and some prostration. Temperature on admission 103.5°. Gonorrhœa 15 years ago. No complications. No urinary disturbances. On admission penis was 6 times normal size, scrotum 4 times normal size and both red, glazed, tense, œdematous, and exquisitely tender and painful. The penile skin was blackish in some parts, but that of the scrotum showed no evidence of gangrene. There was no perineal infiltration. Testicles and epididymes were not made out. Some induration of the groin. A No. 26 F. sound was passed easily to bladder. Under ½ per cent novocain a dorsal slit was made and prepuce retracted, it being thought at first that a prepucial lesion might be present. None was found. The next day the entire penile and scrotal skin was removed, under general anæsthetic, and permanganate dressings (1:500) applied. At operation, a partial necrosis of the right tunica vaginalis was noted and the greater part of the tunica was excised. Smears showed a great number of long chain streptococci but no culture was made on blood media.

During the succeeding week great quantities of slough separated and in 10 days fresh granulations were evident. Blood cultures taken the day following admission were sterile 48 hours after. The temperature oscillated about 103° for nearly a week and then came to normal, the signs of toxæmia gradually disappearing. The patient remained in the hospital 4 weeks at the end of which time scrotal and penile skin regeneration had progressed rapidly. There was, however, some distortion of the parts by the newly formed scar tissue.

Case 2. M. D., a street cleaner age 58, was admitted to Bellevue April 4, 1921. Complained of swelling and soreness of the penis. Three days previous to admission he noticed an itching of the distal portion and scratched the part. Rapidly the penis became red, hot, swollen, and tender. On admission the entire penis was about twice normal size, markedly inflamed, with gangrene and sloughing of the entire ventral half. On the dorsum there were three pea-sized areas of necrosis. The patient thought that these might have been caused by scratching. Smears showed a long chain streptococcus which when plated on blood agar caused hæmolysis. Venereal disease was denied. No urinary disturbances.

A dorsal slit was performed and the organ put in a wet dressing of permanganate 1:500 which was changed twice daily, considerable slough being removed with each dressing. Two weeks later patient was circumcised, such tags of tissue as remained being removed. He was discharged at the end of 3 weeks, wounds healing well, but had not returned since and has been lost sight of. On admission the temperature was 99°. The day after circumcision it rose to 102° falling the next day to normal and remained so throughout his stay in the hospital.

CASE 3. J. K., a laborer, age 60, was admitted to Bellevue Hospital May 11, 1921, with pain and swelling of scrotum and penis. Onset was gradual 2 weeks previous to admission, with increasing redness, pain and swelling of the parts. No history of trauma or infection. No urinary disturbances. Examination revealed an acute inflammation of the penis and scrotum, the dependent portion of the latter being in early gangrene. No inguinal adenitis. The scrotal lesion was not sharply defined. Smears made by puncture through the cauterized skin showed long chain streptococci in great numbers. On blood agar, hæmolysis was produced. A No. 19 F. sound passed easily to the bladder, and prostate was found to be normal. Urine examination was negative. The next day under local anæsthesia, the entire scrotal sac with most of the scrotal septum (all found to be involved) was removed. Bleeding was stopped with hot permanganate dressings. On the left, pus was found to extend up the cord, stopping about an inch inside the external ring. At no time were the systemic symptoms of toxæmia marked, and within 48 hours after removal of the dead tissue, the patient felt improved. On admission the temperature was 101° but dropped to normal in 36 hours and remained so throughout the succeeding course of the disease. On discharge, 4 weeks later, the scrotal and penile skin was granulating over rapidly, the lesion being quite painless. When seen 2 months after discharge, the testicles were nearly covered with epithelium but there was moderate scarring about the base of the penis causing some chronic swelling and œdema of the glans. This condition caused no discomfort however.

CASE 4. J. M., a porter, age 50, was seized with a sharp pain localized in the lower right quadrant shortly after a meal. He vomited several times, took a cathartic with good effect, and came to Bellevue Hospital May 19, 1921, 6 hours after onset. One day previous to admission he noticed a slight drop at the meatus and swelling of the left side of the scrotum. Venereal disease denied, no exposure except wife. Examination showed bilateral enlargement of the inguinal lymph glands with some tenderness. The next day the scrotum was found to be swollen and red, said to be "suspicious of erysipelas." The following day it was the size of a grapefruit and at the lower pole showed areas of early gangrene. The penis too showed involvement being acutely inflamed and twice normal size. There were no urinary difficulties and a No. 20 sound passed to the bladder without difficulty. On this date a direct smear through the cauterized skin was made and found to show streptococci in great numbers. On blood agar, these organisms produced hæmolysis. That afternoon (May 21, 1921) all the scrotal and penile skin showing involvement was excised under gas-oxygen anæsthesia, and hot permanganate 1:500 dressings applied. Incisions were carried posteriorly into the ischiorectal fossæ where large pus pockets were found. (Subsequently the perineal tissues sloughed away.) Because of collections of pus burrowing beneath the penile skin, practically all of this tissue was removed. On the left a small patch of gangrene of the tunica vaginalis was discovered. This was excised leaving the testicle naked. Three days later marked tenderness, redness, and œdema of the nose was noted, the lesion extending somewhat in butterfly design to the cheeks. The patient began to have pain about the mouth. The right elbow and upper arm also were red and œdematous, more especially the elbow. The margins were sharply defined and elevated. The patient gave a history of scratching his face and arm after having scratched the primarily involved tissues. On May 27, the skin over the lower abdomen was red and indurated. Permanganate dressings were applied. Much slough was removed from the scrotal lesions. That night the patient became irrational, tore off the dressings, and had to be restrained. Two days later the cellulitis of the arm was found to be extending whereas the erysipelas of the face was improving. That night patient died with signs of a grave toxæmia. A blood count showed 15,000 white cells, 92 per cent of which were polymorphonuclears. The temperature on admission was 104 and varied little during the course of the disease.

CASE 5. A. F., a peddler, age 61, was admitted to Bellevue Hospital May 24, 1921, complaining of pain and swelling of the scrotum and penis. Venereal disease denied. The onset was rather sudden, 3 days before, when he noticed swelling, redness, and pain localized to the scrotum and penis, beginning first on the former. Rapidly these symptoms increased in severity but there was no marked systemic reaction. On the day of admission to the hospital, these organs were found to be about three times normal size, showing all the evidences of an acute inflammatory process with patches of gangrene at the lower pole of the scrotum. Near the prepuce two brownish areas of early gangrene were noted. The skin redness was in no sense demarcated. There was no enlargement of the inguinal lymph glands nor was there any difficulty of urination. A No. 26 F. sound passed readily to the bladder and rectal examination revealed no abnormality of the prostate. On admission, no involvement of the perineum was noticed but the following day the buttocks in the region of the ischiorectal fossæ were inflamed and œdematous. Smears and cultures made from material obtained through the cauterized skin surface showed a hæmolytic streptococcus of the long chain variety. Under local anæsthesia the penile and

scrotal skin was removed, and long incisions were carried posteriorly into the buttocks, gangrenous tissue and many pus pockets being encountered throughout. Hot permanganate dressings and daily hot baths constituted the further treatment, the slough being cut away daily. Two days after the primary incision the perineum came away, this being a most unusual condition and one noted in the literature but once. After a week granulation tissue was evident and with surprising rapidity the scrotal skin began to regenerate. Patient left hospital healing rapidly; has not returned for observation.

CONCLUSIONS

1. Acute streptococcus penile and scrotal gangrene is a clinical entity readily distinguishable by careful examination from urinary extravasation, diabetic gangrene, and the passive œdemata of certain other organic diseases.
2. It is apparently an acute streptococcus infection of the skin and subcutaneous tissue comparable to erysipelas.
3. Like erysipelas, it spares the underlying structures.
4. Unlike erysipelas, it is characteristically a gangrenous process, though gangrene is not unknown in erysipelas elsewhere in the body.
5. Mortality is between 20 and 25 per cent.
6. Spread of the disease may be controlled by excising gangrenous skin and draining gangrenous, and suppurating subcutaneous tissue.
7. Regeneration of scrotal skin is rapid.

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CALCULI WITHIN THE BRAIN

Report of a Case of Intracranial Calcification with Successful Operation and Recovery[1]

By ELI A. MILLER, M.D., Denver

INTRACRANIAL calcification is encountered but rarely in the practice of medicine as indicated by an examination of the literature. An exhaustive study of the subject was recently made by Heuer and Dandy who found up to 1916 there had been but 7 cases reported, all by foreign observers.

Lichtheim had demonstrated a calcified gumma. Fittig observed by roentgenological examination three calcified areas in cyst walls in the occipital lobe of a brain; Grunmach noted a shadow due to a calcified tumor of the pineal gland; Schuller reported an osteoma in the frontal region; Algyogi, a basal tumor, with areas of calcification; Kleinberger, a tumor in the occipitoparietal region; Stieda, a calcified cysticercus; and Strater a calcified brain abscess recognized after its disclosure at operation.

Heuer and Dandy reported 6 cases of their own found in a study of one hundred clinically demonstrated brain tumors as follows: One case of calcification of the brain substance, one of calcification in the sella, one of aneurism of the internal carotid artery, and two cases of calcification above and very close to the sella.

Subsequently George reports the case of a man 23 years old in whom stereoscopic examination of the head made in the lateral position showed an area of about 3 centimeters in diameter posterior to the sella with apparently calcified walls. The patient had been injured in the head while playing football and rendered unconscious. He subsequently developed epileptic attacks which persisted for 18 months, when an operation was performed which revealed a small tumor situated just below the pia mater and adherent to the midfrontal lobe, diagnosed as an encapsulated glioma.

J. T. Murphy reports the case of a woman, age 47, in whom the X-ray showed a series of fine calcified lines each forming a part of a circle which was seen to be above and behind the sella and about midway between the left side of the skull and the median line, the whole making a barrel-shaped shadow. The

[1] Read before Denver County Medical Society, November 15, 1921.

exact diagnosis was not clear to the writer, but he seemed to think that it was either a cyst of the brain or an aneurism of the anterior cerebral artery. His patient suffered with paralysis of the right arm and leg, there was a disorder of the faculty of language, drooling from the right side of the mouth, convulsions and headache. The patient was placed on small doses of iodides. She improved greatly. Most of the symptoms subsided, only a small facial paralysis remaining.

Bassoe and Hassin give a detailed clinical and histological report of a man age 32 in whom there was calcification of cerebral vessels with a clinical picture simulating brain tumor. Histologically there was an indurated area measuring about 2 by 3 centimeters, occupying the basal ganglions and centrum semiovale. It was ill-defined, merging into the surrounding normal tissue, and it was in this area that microscopic, pale, calcified, bodies were present. They conclude that the white substance of the brain may be the site of a peculiar degenerative process followed by calcification. The lime deposits originate in the tissue spaces which primarily show a hyaline or colloidal degeneration as the result of some metabolic disorder. The degeneration results in defective drainage of the tissue fluids which become stagnant and ultimately calcified.

True bony tumors (osteoma and osteosarcoma) or tumors which have undergone calcification or ossification, cast shadows on the X-ray plate that can be readily recognized; nevertheless a search of the literature reveals less than twenty recorded instances.

The case described here differs markedly from those found in the literature in that the roentgenological examination reveals shadows which have the appearance of stones or calculi within the brain substance and these were successfully removed at operation.

Mr. F. A. D., age 60, a garageman by occupation presented himself October 10, 1921, for the relief of epileptic attacks, which had become more severe and more frequent recently; he had had from three to five attacks a night during the previous week.

The patient had the usual childhood diseases including measles, mumps, and scarlet fever at 12 years of age. At the age of 14 he had had an attack of appendicitis, but was not operated upon. During this attack he had been confined to bed for over 6 weeks, and was very seriously ill with a high fever and a marked swelling in his right side. He had no trauma and denies venereal disease. He uses neither alcohol nor tobacco.

Fig. 1. Roentgenogram. Three small calcified areas in left parietal region embedded in brain, two about ¾ inch deep, and one about 1 inch deep.

About 26 years ago, the patient had his first epileptic attack which came in the night without any warning. There had been nothing unusual in his activities on the day before. The patient was awakened from a sound sleep by a terrible grinding sensation in his head over the left parietal region, and there was a slight twitching in the fingers of his right hand, also there was vertigo, faintness, and sudden visual sensation followed by cloudiness of consciousness.

Subsequent attacks occurred at intervals of about a year or year and a half in the following 10 or 12 years. Then he had the attacks more frequently. In 1913 he was having an average of two attacks a month. He was operated upon by Roswell Park at Buffalo General Hospital in June, 1913. A trephine was performed; a tumor in the left parietal region was suspected; nothing, however, was found and the attacks returned a few weeks after operation. In the last 2 years he was subject to two or three spells within a few days and then he would be free from attacks for a week or more.

There is no family history of epilepsy, insanity, diabetes, kidney, or heart disease. His father died of cancer of the stomach at the age of 65, his mother died of pneumonia at the age of 56, his wife died following an operation for uterine fibroids. One daughter, age 24, is living and well, one son, age 26, has pulmonary tuberculosis, one daughter died following childbirth, at the age of 22.

At the time of presenting himself for relief the patient was subject to three to five epileptic attacks

Fig. 2. Photograph of calculi. Natural size.

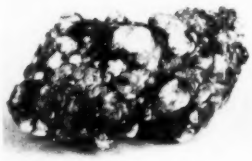

Fig. 3. Enlarged photograph of first stone.

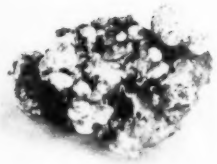

Fig. 4. Enlarged photograph of second stone.

a night. These attacks come on for the most part a few hours after going to bed. He is awakened suddenly by an aura in which he feels numbness and tingling of the middle and ring finger of the right hand. Then these fingers begin to twitch, this is transmitted to the thumb, the hand flexes forcibly on the forearm, and forearm on the arm. The right side of the face twitches, later becoming more generalized and the entire body becomes affected with convulsive movements clonic in character. He does not cry out in the beginning of the attack, and remains in a state of consciousness throughout the greater part of the attack. He has a most distressing awful grinding sensation in his head in the left parietal region and it seems to him ages of torture, before he is finally blessed with loss of consciousness. He has enough warning to be able to self-administer chloroform which sometimes aborts the attack. Each attack lasts from 20 minutes to half an hour and recurs at short intervals several times during the night. During the attack his consciousness is clouded and mental faculties are dulled, but after the attack is over he is normal. He has no false sight or hearing during or following the attack.

Further he complains of nocturia 4 to 6 times per night since the onset of his frequent epileptic attacks, of pain in the back across the sacro-iliac region which was entirely relieved by strapping, of weakness in his right hand. When walking he feels like falling due to a sinking sensation and weakness. There is no burning on passing urine, no swelling of ankles, and no puffiness of eyelids or face. He is either badly constipated or has severe diarrhœa.

Physical examination. October 10, 1921. The patient is a well-developed, well-nourished individual 5 feet 8¾ inches in height weighing 176 pounds. His head is round and symmetrical, his ears are normal, he has a scar over the left parietal region marking the site of the previous operation, but there are no scars due to falls. This area is soft and no masses are palpable. His pupils are equal, they react normally to light and accommodation; the eyelids close normally. Many teeth are missing and the remainder are in bad condition. The tongue shows no scars or signs of being bitten; it is moist, coated, and protrudes slightly to the right with a fine tremor. There is some smoothing out of the right side of the face but mouth is not drawn to either side on showing teeth or laughing.

Chest. The lungs appear to be normal. The heart borders are normal to percussion; the second sound in the mitral area is somewhat muffled, the cardiac rate is seventy-six, and the rhythm is good. Examination of the abdomen reveals nothing abnormal. There is a marked paresis of the right hand, the grip of the right is very much weaker than the left, although patient has always been right handed. There is some atrophy of the muscles of the right hand.

Ophthalmoscopic examination was made by Dr. Stillwill who reports that there are no tortuosities of the retinal veins and arteries, that the nerve head is of normal color, that the choroidal ring is not distinct, and the cornea and iris are clear.

The systolic blood pressure is 170, the diastolic 105. A Wassermann test on the blood gave a negative reaction. Urinalysis reveals a trace of albumin and an occasional hyaline and granular cast. Several subsequent examinations of the urine after the patient was put on increased fluids and the use of chloroform was abandoned, were negative for albumin and casts.

Mentally, patient is of more than average intelligence and does not manifest any impairment.

Roentgenological examination was made by Drs. Childs and Crosby. Stereoscopic plates show several calcified areas within left parietal lobe. These bodies seem to be just subcortical in white matter.

The patient was put on 1 grain luminal twice a day at 4 p. m. and at 9 p. m. which at first seemed to stop the attacks, but he complained of being "out of his head" during the time he was under the influence of the drug, and he refused to continue it.

Small doses of iodides, and bromides in the form of the elixir of sodium bromide, a dram four times a day, seemed to reduce the number of attacks greatly. Under a general hygienic régime, with increased fluid intake and improved elimination, his blood pressure was reduced to 155 systolic and 90 diastolic, albumin and casts disappeared from the urine. The general condition of the patient was much improved, although he was showing the effects of bromides. He was beginning to have many minor attacks some of which he could abort by a tight constriction about the wrist.

Operation. The patient was operated upon November 5, at St. Anthony's Hospital, Denver.

Under ether anæsthesia, a semilunar incision over the left parietal region was made beyond the old trephine area down to the periosteum of the skull. A large horseshoe-shaped flap of scalp was turned down, great care was taken in the separation of the scalp from the dura at the site of the previous operation. There were dense adhesions to the dura, but by careful dissection with a periosteal elevator a fine separation was accomplished. The dura was fibrous, dense, and somewhat tense. A curved incision in the dura over the left motor area was made and a flap turned down. There was some bleeding from the brain surface, but it was easily controlled. The surface of the brain appeared normal. On introducing a needle into the substance of the brain in the parietal region on a line with the external auditory meatus resistance was felt 1 inch from the surface. There was a twitching of the right hand. After careful separation of the brain tissue a solid mass was elevated. This calculus was crushed by the grasp of the forceps. Palpation with a finger in the opening through which the first calculus was removed revealed two other calculi lying posteriorly in a smooth walled cavity. These were removed without breaking by grasping them with Allis forceps guided by the finger. The cavity in which they were lying was smooth to the touch. There was very little destruction of the brain tissue by the operation. It was possible to make an excellent closure of the dura and scalp without any bulging of the brain.

On postoperative examination after recovery from the anæsthesia the right hand was found to be paralyzed, there was no impairment of speech; no facial paralysis; no paralysis of the right arm and forearm. The hand was flaccid with the fingers flexed. This condition is improving. The patient was given urotropin (hexamethyleneamin) by mouth for 2 days previously and for a week after operation. He has had no epileptic attacks since operation.

Pathological report. The specimens removed at operation are solid calculi, grayish white in color, irregular in shape, with many projecting nodes like the mulberry. One of these measures ¾ inch by ½ inch by ½ inch, the second measures ⅝ inch by ½ inch by ⅜ inch, the third was approximately of the same size but was crushed in removal.

Chemical analysis was made by Drs. Hillkowitz and Gauss. They report that the calculi are composed almost entirely of calcium oxalate with organic material, probably decomposed blood.

Intracranial calcification may be classified under the following general heads:

The first is the calcification which occurs in cyst walls and in the walls of abscess cavities. These cysts have been observed both in infancy and adult life. Infants showing cyst formation usually present evidence of impaired mental development or a spastic paraplegia. The calcification occurring in adult skulls are usually associated with cysts which are secondary to a fracture of the skull or subdural hæmorrhages.

Under the second are grouped the deposits of so-called "brain sand." Among these are the deposit of lime in the pineal body. The deposit of brain sand in the falx cerebri, the so-called psammoma, are classified by some pathologists as true bone tumor or osteoma.

Under third heading is the calcium deposit in the walls of the blood vessels of the brain.

Under the fourth heading is the deposit of calcium in brain tumors, and with these are included gummata and tuberculomata.

Under the fifth are grouped the true bony tumors osteomata and osteosarcomata.

Finally there is the class of calcified bodies which occur in the white substance of the brain upon the site of a peculiar degenerative process of which Bassoe and Hassin speak. The lime deposits originate in the tissue spaces which primarily show a colloidal degeneration as the result of some severe intoxication with consequent metabolic disorder. The degeneration results in defective drainage of the tissue fluids which become stagnant and ultimately calcified. It seems to me that this is the probable explanation of the calculi within the brain substance in my case.

In conclusion the writer wishes to thank Dr. L. I. Miller, Drs. McCartney and Sams for their kind advice and assistance; Drs. Childs and Crosby for their roentgenographic studies; Dr. Stillwill for his ophthalmoscopic examination; and Drs. Hillkowitz and Gauss for their pathological and chemical studies.

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UTERINE HÆMORRHAGE OF ENDOCRINOPATHIC ORIGIN[1]

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THE process of menstruation is dependent on the interaction of the chain of ductless glands and the uterus. Whether the uterus can be accepted as a ductless gland is still unsettled. The myometrial gland has not been definitely proved to have a constant existence or an internal secretory function. We know that the presence of the ovaries alone does not insure the menstrual function but that the absence of the ovaries precludes the advent of this process. The presence of uterus and ovaries may not result in the appearance of the periodic monthly uterine hæmorrhage, for in some instances, individuals with apparently intact pelvic organs may have no menstrual flow or may have a more or less periodic flow from other body surfaces, i.e., so called vicarious menstruation.

We can see from these facts that the function of menstruation depends on other factors than the mere presence of the uterus and ovaries. To menstruate normally, a woman must have uterus, ovaries, and the *proper stimulus* from some *other source* which has been hypothetically accepted to be the ductless glands. There seems to be no definite gland that elaborates the stimulus, though, as we have already mentioned, the presence of functionating ovaries is absolutely essential.

Because of the pathological variations in the menstrual function in many diseases associated with endocrine disturbances, such as myxœdema, exophthalmic goiter, acromegaly, dystrophia adiposo genitalis, tumors of the hypophysis and adrenals, it has been assumed that all these glands play a rôle in the production of menstruation, and, that variations in the physiology of these glands result in disturbances of the menstrual function. In other words the entire chain of the so-called ductless glands is involved in the process of initiating normal menstruation and variations from the normal type must be due to disturbances in one or the other of these glands or in a group of them, leading to a flaw in the normal concerted action of the chain.

Uterine hæmorrhage aside from the normal periodic bleeding has been in a gross way classified in two large groups: (a) due to systemic conditions, (b) due to local conditions. Under (a) are grouped cardiac diseases, diseases of the liver and kidney, anæmia, hæmorrhagic diatheses, as purpura, and the acute infectious diseases, as scarlet fever. Just what causes the bleeding in these cases other than a local congestion is difficult to state as the description of this symptom and observations of its course, and character of its variations, in the course of the above-described diseases are very meager.

Under group (b) we have bleeding due to (a) local inflammatory lesion of the pelvic organs, (b) malpositions and displacements, (c) foreign bodies, (d) tumors of the pelvic organs, (e) a condition with no gross lesion but some histological (?) or physiological changes in the uterine wall, vessels, or ovaries.

The bleeding due to local inflammatory diseases, malpositions and displacements or foreign bodies is in most instances scant in amount and in all probability is dependent on the mechanical disturbance to the pelvic circulation or local injury. Some of the instances of profuse hæmorrhage may in these cases also be due to some interference with the proper function of the pelvic organs, as ovary or uterus. The two subgroups, "tumors and non-demonstrable gross lesions," form a topic of great interest. It has been assumed that in cases of tumors of the pelvic organs, the mechanical affect of the tumor accounts for the bleeding, though no thought is given to the many instances where tumors occupying similar positions as those associated with hæmorrhage as a symptom, do not cause bleeding.

Bleeding due to tumors can be divided into two types: Those in which the hæmorrhage is a purely local manifestation of an erosive or ulcerative condition of the tumor and those

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in which, without invasion of the uterine cavity or ulceration of its walls, we have bleeding, often of a most intractable nature. The first type is illustrated by the carcinomata of the cervix or uterus. Here we have a very friable neoplasm which at the slightest trauma bleeds because of the damage directly done to vessels in the tumor proper. This, too, is true of other types of submucous growths that have by pressure or degeneration and necrosis opened vessels of greater or lesser size and that bleed because of the direct injury to the vascular channel.

The second type cannot be explained on these grounds as they have not opened vessels, nor caused erosion of the mucosa, nor are they friable or exposed to trauma. Under this heading is the great group of fibromyomata and ovarian and tubal tumors. Here the symptom of hæmorrhage is a varying one. True, in most instances of fibromyomata there is a history of atypical uterine hæmorrhage, but truly not dependent on any local effect in a majority of the cases.

In a study of 250 fibroids, 192 gave a history of menorrhagia or metrorrhagia irrespective of the size or situation of the tumor. Of the 58 that had no menstrual irregularities, there were many that grossly were identical in size and situation with some that were associated with pathological uterine hæmorrhage. This makes it unlikely that purely mechanical factors played a rôle in these instances.

A histological study of the mucosa in these (Fig. 1) 192 cases show in 168 a marked hypertrophy irrespective of the phase of the normal menstrual cycle. This was the only constant lesion found. It has already been described in detail in a previous paper (1). It might be mentioned here that this change in the mucosa is also a characteristic in cases of uterine hæmorrhage without gross lesions as will be mentioned later and also in cases of ovarian and tubal tumors (Fig. 2) accompanied by metro or menorrhagia. We see that it is not the size, shape, mechanical embarrassment to the pelvic circulation nor the ulceration or necrosis of the tumor that gives rise to this atypical bleeding and we must, therefore, seek another explanation to

Fig. 1. Mucosa form a uterus containing multiple fibroids, bleeding for 3 weeks.

account for the phenomenon. As we previously suggested in the paper quoted above, we must look for the etiological factor in some disturbance of endocrine balance. We can also utilize for purposes of argument the similarity between the histological picture of the hypertrophied mucous membrane found associated with this condition and that of the normal premenstrual phase, as well as that seen in the cases of so-called "essential uterine hæmorrhage." The reaction of the mucosa in the three types of cases is so similar that it seems reasonable to suppose that the same stimulus, namely endocrine activity either the product of one gland (the ovary), for that at least is essential for this change, or a group reaction is responsible for the hypertrophy.

In view of the fact that removal or raying of the ovaries will cause a disappearance of the mucosal hypertrophy and also a cessation of the hæmorrhage, it is proper to conclude that its activity at least is necessary for the two processes and so give weight to the supposition that the hæmorrhage associated with fibroids, except in those instances mentioned above as due to local effects, is dependent on an endocrine disturbance.

The same method of reasoning and the same findings in the mucosa would lead us to

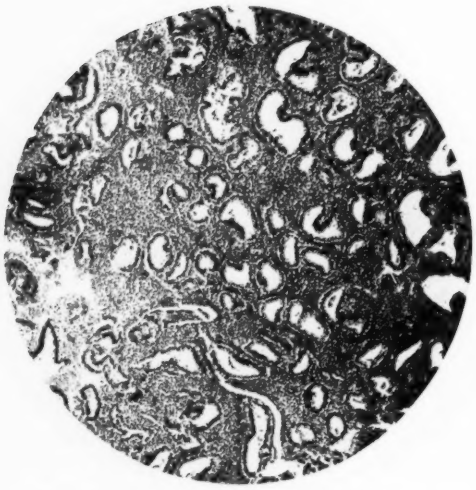

Fig. 2. Mucosa from a uterus in a case of ovarian cyst, bleeding for 5 weeks.

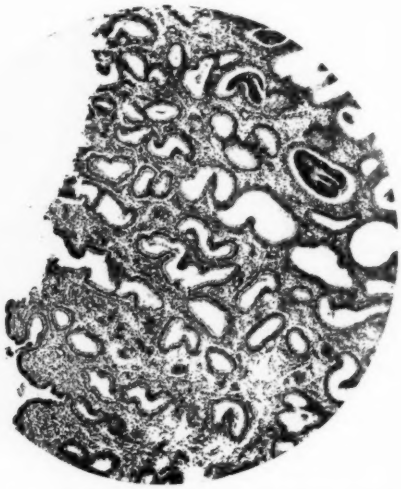

Fig. 3. Mucosa from a case of essential uterine hæmorrhage, bleeding 8 weeks.

similar conclusions in reference to the hæmorrhage associated with tumors of the ovary. Abnormal bleeding is not a common symptom associated with ovarian tumors and it is only in those cases where the function of the ovary is abnormal, resulting in a disturbance in the entire endocrine balance, that this expresses itself in uterine bleeding of an atypical character. Here, too, the findings in the uterine mucosa would tend to substantiate this theory.

An interesting group of tumors are the uterine polyps. By this term is meant small pedunculated masses composed of endometrial tissue and not pedunculated fibroids submucous in situation. These local growths seem to me not to be true neoplasms but more in the group of local hypertrophies. One finds them often associated with fibroids, at times solitary, at others multiple. Again they are present with no other lesion except perhaps an hypertrophy (more or less marked) of the mucosa. They are often associated with atypical uterine bleeding, either an exaggeration of the normal period (menorrhagia), or sometimes metrorrhagia is present, especially if the polyps are ulcerated. It seems rather odd that these growths of the same elements as the mucosa should give rise to the rather profuse hæmorrhage that characterizes them at times. The examination of these small tumors grossly and histologically does not offer a rational explanation. They are not always eroded or necrotic. Often they are very hæmorrhagic, much more so than the remainder of the mucosa, especially when they protrude through the internal os. They are not malignant, they do not grow very large, they do not infiltrate, or metastasize, though a malignant tumor may develop at their site. There is a tendency for more of them to form when they have been removed by some local procedure. The impression created is that they are the result of some stimulation that produces local hypertrophy instead of the general hypertrophy as seen in the essential hæmorrhage type of case, or in cases associated with fibroids. They are, however, often found in addition to the general hypertrophy present in bleeding cases, and it seems that the hæmorrhage so commonly associated with these polyps is the expression of a general process of which the polyp is just a local manifestation.

In the normal menstrual cycle the uterine mucosa undergoes a periodic variation with an overlapping of the different phases. This was pointed out first by Hitchman and Adler

and has since been corroborated by a large number of investigations. The varying phases are well known and need no further gross descriptions.

It is still accepted by many medical men that the hæmorrhage one encounters in women who have no grossly demonstrable lesion except a uniformly enlarged uterus is due to a fibrosis, an endometritis or a vessel disease.

It has been repeatedly demonstrated that endometritis is a very rare disease, except the acute type that follows instrumentation or delivery, and that the condition, chronic endometritis, is rarely present in cases that have atypical uterine hæmorrhage, and can hardly be held to be the etiological factor in a condition that is much more conspicuous by the absence than the presence of its supposed cause.

It was pointed out also (2) that in cases of so-called essential uterine hæmorrhage, the one characteristic finding in the uterus was an hypertrophy of the mucosa simulating an atypical premenstrual phase with œdema of the stroma, enlarged, sometimes tortuous, almost always, cystic glands, and this irrespective of the stage of the menstrual cycle (Fig. 3). It was suggested that the stimulus that caused the normal changes in the mucosa also caused by some perverted activity, the abnormal condition found in the bleeding cases. Furthermore, because we know that these changes do not take place after the removal of the ovaries or the abolition of their functions, we advanced the theory that the ovaries are essential for the change in these pathological cases. As we know that the ovaries are essential for the production of the uterine bleeding, normal or pathological, we conclude that the same factor is the causative agent for the hæmorrhage and for the hypertrophy. We see, therefore, that all cases of uterine hæmorrhage, not associated with tumors that are ulcerated, necrotic or friable or with conditions that may be dependent on purely local pressure or congestive phenomena such as tubal pregnancies, inflammatory diseases or displacements, and accompanied by a definite pathological, almost pathognomonic, condition of the mucosa are dependent on the presence of the ovaries. These findings lead us to the supposition that bleeding and hypertrophy of the mucosa are due to a stimulation dependent in part, at least, on the activity of the ovary. Whether the mucosa itself plays a rôle by the production of a substance or substances that actually precipitates the hæmorrhage and maintains it cannot be stated, but it seems possible that the mucosa in its hypertrophic condition is producing some substance which may be an active factor.

Analyzing our cases of hæmorrhage, whether due to fibroids, ovarian or tubal tumors, or in those cases where no gross lesion exists, we must admit a striking fact that they can all be cured by the removal of the ovaries or by raying in proper dosage and that they all are characterized by the hypertrophied mucosa previously described.

In view of this, I feel that it is fair to suggest that all these cases when associated with bleeding have as the etiological factor for their hæmorrhage, not the local condition, but some disturbance of ovarian function which may or may not be the only factor involved. In all probability it is only one of the glands at fault, the result of this variation being that the entire chain, i.e., thyroid, hypophysis, adrenal and ovary, does not functionate normally. This abnormal action of the endocrines expresses itself in the hypertrophy of the mucosa which tissue may be the source of some chemical stimulus that initiates and maintains the bleeding.

Unfortunately at the present time endocrine therapy is still in the experimental stage and most of the administration of the various products is purely based on empiricism. It is to be hoped that eventually we shall have developed a rational therapeusis, and it will be in just these cases of pathological hæmorrhage that much good will be accomplished.

I wish to thank Dr. F. S. Mandlebaum, director of the Pathological Department, for the excellent photomicrographs and for the privilege of studying the material.

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DEPARTMENT OF TECHNIQUE

CORRECTIVE RHINOPLASTY

Some Anatomicosurgical Considerations[1]

By LEE COHEN, M.D., F.A.C.S., Baltimore

THE widespread interest manifested in corrective rhinoplasty during the past decade has finally given to this class of work the real place in surgery to which it is entitled. Some men, however, still maintain an air of opposition on the ground that such purely cosmetic work is unworthy of serious surgical consideration. I take issue with my friend, Dr. Beck (1), in his recent "Review of Twenty-five Years Observation in Plastic Surgery, etc.," who would differentiate between patients really requiring operations because of mishap and those with congenital deformities who merely desire operations for cosmetic reasons. As a matter of fact, all plastic operations about the face are, as I see them, for the sole purpose of improving the individual's appearance. No surgeon would refuse to restore form, where possible, to a nose sunken from septal abscess. Why then refuse correction of an equally deformed nose of this type, of congenital origin? Likewise, when a patient is made self-conscious and his entire mental outlook on life is perverted, through the possession of a grossly oversized or humped nose, why should he not be accorded the same privilege of relief?

In the above-mentioned review, Beck further emphasizes the element of neurosis and the difficulty in satisfying many of these patients. In my experience, patients with deformed noses are no more neurotic than those with other deformities about the face, such as hare-lip, squint, scars, etc., and, but for the existing defect, quite likely the nervous system of none of them would be disturbed. The obvious remedy for this neurosis in any case, therefore, is a correction of the deformity. Moreover, the gratitude shown by no class of cases compares with that of patients after the successful performance of these plastic operations; their joy and happiness has to me been a real inspiration.

In this, as in all other surgical procedures widely employed, the most expert cannot always expect ideal results. How much more likely then are utter failures to occur in this tedious and quite difficult field in the hands of some who, after witnessing a few operations, attempt them without anatomical study, practice on the cadaver, or in many instances without even a moderately liberal training in general surgical technique. These same men, with no greater training, would hesitate to perform a major abdominal operation wherein failure might register a death to their credit. In no other field of surgery does close attention to the most minute detail, both in the operation and after dressings, count for more in obtaining the desired result. It seems, therefore, timely here to sound a note of warning to men who contemplate doing this work, and to emphasize the need of careful preparation and study, lest failure crown their operative effort and bring upon them, and upon the work as a whole, the opprobrium of the patient and the profession as well.

In previous monographs (2, 3, 4, 5, 6) almost all types of nasal deformities have been considered by the writer and many phases of the subject discussed, but there are some finer details in technique that might still be brought out.

I would here first present for your consideration the reduction of congenital overgrowth of the cartilaginous nose, existing in many instances without deformity of the bony portion. Although this operation may seem trivial compared to some of the more extensive work on the bony nose, the surgeon's judgment is often taxed to its utmost in determining the extent of the incision and how much tissue should be removed.

Figure 1 represents the skeleton of a nose with a markedly oversized cartilaginous portion; not only is it too wide but the tip stands prominently above the dorsum of the rest of the nose. This exaggerated tip is, in the vast majority of cases, due to an overgrowth of the greater alar cartilages, although in some instances the lateral cartilages also take part in a more general enlargement. In

[1] Read before Clinical Congress of American College of Surgeons, Philadelphia, October 26, 1921.

Fig. 1. Skeleton of nose with markedly oversized cartilaginous portion. Not only is it too wide, but the tip stands prominently above the dorsum of the rest of the nose.

Fig. 2. The double-edged pointed knife, curved on the flat, is tunneling its way between the cartilage and the overlying skin. The knife is introduced from within the nose 3 millimeters above the edge of the anterior nares, close to and on each side of the septum.

each case it is necessary to determine before operation whether one or both pairs of cartilages are overgrown, as the amount of tissue excised must vary with the extent of the enlargment.

Figure 2 indicates the double-edged pointed knife, curved on the flat, tunneling its way between the cartilage and the overlying skin, having been introduced from within the nose 3 millimeters above the edge of the anterior nares, close to and on each side of the septum. The knife penetrates the lining and cartilage and tunnels its way upward over the tip, beneath the skin, until it passes the uppermost limit of the overgrown area, where the point again enters the nasal chamber. This may be at the dividing line between the major alar and lateral cartilages, or where the lateral cartilages are attached to the bony edge of the pyriform opening. After sufficiently widening these tunnels by cutting laterally, a strip of tissue 5 to 7 millimeters wide, including the cartilage and its lining, is excised from the dorsum on both sides of the septum, as indicated in Figure 3. The punch forceps of Joseph or a pair of straight pointed scissors may be used for this purpose.

The width of the nose is thus reduced in direct proportion to the width of the strips removed. Care should be taken, therefore, that too wide a strip be not excised, lest the breathing space be unduly diminished after healing and subsequent contraction.

In order to narrow the nose to the desired extent, two other incisions must be made, also from within, extending laterally from the upper end of each of the vertical defects to the root of the nose, thus permitting the edges of the dorsal defects to fall into apposition. Sutures are not required in these situations. In fact, any attempt to use them results in a puckering of the overlying skin. Lateral compression of the lower end of the copper splint, after it is placed over the nose, is relied upon to hold the wound edges in contact.

To lower the tip and place it on a proper plane with the bony dorsum, incisions are made in the mobile septum, as indicated in Figure 4. With a double-edged, straight-pointed knife, the subseptum is transfixed just above the skin edge of the columella, and a cut extending from the tip to the anterior nasal spine is made through the entire septum. The septum is again transfixed at the junction of its cartilage with the subseptum, and an incision about one-third shorter and parallel with the former one is made. Now, with a pair of straight pointed scissors, a section of the entire septal tissue between these two incisions is excised. The length of the section thus removed should be in proportion to the extent of the desired replacement of the tip. Generally speaking, it varies from 0.5 to 1 centimeter and must not exceed this amount, or later contraction is likely to overcorrect. Besides, where too much tissue is removed the redundancy of skin covering the columella is not entirely overcome by shrinkage, and an unsightly puckering results after suturing. When the gap created by the removal of this section is closed, by bringing the anterior and posterior edges together with one through-and-through suture of heavy black silk (indicated

Fig. 3. A strip of tissue 5 to 7 millimeters wide, including the cartilage and its lining, is excised from the dorsum on both sides of the septum.

by dots), the tip is drawn downward. A sufficient number of superficial sutures of finer silk on each side of the septum serve to close the wounds completely.

The method of dressing may be of interest. The nasal fossæ, for an inch back of the vestibules, are packed with half-inch iodoform tape, leaving a portion of both vestibules just above the nares unpacked. The packing of this lower portion is now done in the following manner:

Fig. 5. Modification of Killian's speculum used to introduce the graft in correcting concave dorsal deformities.

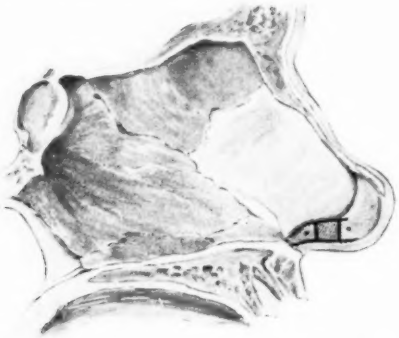

Fig. 4. Incisions are made in the mobile septum to lower the tip and to place it on a proper plane with the bony dorsum.

a gauze strip, laid flatly against the left side of septum, is brought downward out of the nose, around the columella, and carried upward into the right vestibule along the septum, when it is folded upon itself, again brought downward, around the columeila, and into the left nares; and so on until both sides are loosely filled with gauze tape, which furnishes a perfect dressing over all septal wounds and the columella itself. A narrow strip of adhesive over this gauze covering the columella, and drawn snugly upward on both sides in the shape of a swing to be attached to the splint above, serves to hold the wound edges closely in contact, and lessens tension on sutures.

In applying the copper splint in these cases the adhesive strip holding it should be placed on a slightly lower level than usual, so that pressure thereby exerted on the tip of the nose will still further reduce tension on the main through-and-through suture.

The patient is required to remain in bed 4 days and to spend as much time as possible on

Fig. 6. Position of graft to take the place of the quadrilateral cartilage destroyed by septal abscess.

Fig. 7. Case 1 before and after operation.

Fig. 8. Case 2 before and after operation.

the back, so that the nasal secretions flow backward into the throat and lessen the likelihood of wound infection. The first change of packing is made on the fourth day, sutures being removed on the fifth. The splint should be continuously worn for 2 weeks, changing it every third or fourth day for purpose of skin toilet. In a number of cases thus cared for, primary healing and satisfactory results have been obtained, without exception.

Illustrating results, photographs of several patients before and after operation are here shown.

Case 1. Male, age, 20. Had a large bulbous tip projecting high above the plane of the rest of the nose. In the after-picture which we were obliged to take a couple of weeks after operation, because patient was forced to return to his home in Iowa, there still remains considerable general swelling, but the dorsal plane of the nose, you will observe, is perfect. This gross appearance will, as time goes on, disappear entirely with the sweiling.

Case 2. Female, age 25. Swelling having disappeared before taking the after-picture, the nose presents a more natural form.

Case 3. Female, age 28. The nose was shortened and irregularities of the dorsum removed by operation in 1915. Patient returned 2 months ago and asked that the distance between the tip and root of the nose be reduced. This was done in the manner above described. The after-picture in this case was also necessarily taken before the swelling had entirely disappeared.

Perhaps of far more general interest, because the results appear more striking, but by no means so difficult of execution, are the operations for correcting concave dorsal deformities (so-called saddle nose), either congenital or acquired, by the use of bone or cartilage grafts. Grafts of septal and of costal cartilage have been used by different operators. Bone from the lower turbinate, the tibia, and that of the rib has been variously employed. All of these have been tried by the essayist, except the septal cartilage, which in my opinion has no place in this work, as absorption is certain to follow; besides it is seldom thick enough for the purpose.

Gillies' idea of using costal cartilage alone in all cases has not proven wise, in the experience of the essayist. Such grafts never form union with bone and are, therefore, never firmly fixed on the nose; they are always absorbed to a greater or less degree.

Likewise, bone grafts from the anterior edge of the tibia have proven a failure in several of our cases. The biological difference between the nasal bones, which in their construction, nerve and blood supply, closely resemble the rib, and the tibia with its large narrow canal and haversian system, would seem sufficient reason why the tibia graft does not unite with bones of the nose and become a fixed part of its bony framework. Then, too, after 4 or 5 years, so much of the tibia graft is lost through absorption that the results have been a disappointment to both patient and operator.

The irregularity of the lower turbinate, its thinness, and the fact that it is removed from a bacterially laden cavity, seem sufficient reasons for discarding it entirely in these operations.

The ideal substance in this work, as shown by results of the essayist, and also of Carter, has proven to be a graft composed partly of bone and partly of costal cartilage, taken from the seventh or eighth rib. The bony portion of this graft in all of my cases is firmly united to the nasal bones within 6 weeks. The costal cartilage, removed with and left attached to the rib bone, lies over the cartilaginous nose, and permits a certain amount of mobility in that portion not to be

Fig. 9. Case 3 before and after operation.

Fig. 10. Case 4 before and after operation.

obtained by bone alone. Besides a graft thus constituted can be made so long that the lower end presses slightly on the tissues of the tip of the nose, without any danger of subsequent sloughing of the skin from the pressure of the cartilaginous end of the graft. In this manner, therefore, by means of a dorsal graft, the nose can be made a trifle longer when necessary.

Danger of perforating the pleura, with a resultant empyema, has been offered as an objection to the use of the rib. Also the difficulty of properly shaping the bone, as compared with the costal cartilage, has been urged as another reason for the use of the latter alone. While perforation of the pleura is a very undesirable occurrence, and happened twice in my early work, without infection however, it cannot be held as a reason for not making use of the rib graft. With improvement in technique as the operation is now performed, perforation of the pleura need never occur. Moreover, if one's asepsis is beyond criticism, infection does not follow such perforation.

When but a shallow depression of the dorsum exists, it is unnecessary to take a section of the entire rib. A strip of the outer table, through the diploic structure down to the inner table, removed with sharp chisels, furnishes all the thickness required. In marked cases of saddle nose, where the entire rib thickness is needed to fill the defect, the periosteum of the outer table is twice incised along the axis of the rib. The distance between these two incisions, generally from three-sixteenths to one-quarter inch, indicates the width of the graft to be used. These incisions are extended as far into the costal cartilage as desired, and, of course, their entire length must vary according to the estimated length of the graft required. In this way the periosteum of the outer table is left attached to the graft. With a periosteal elevator, the remaining portion of the periosteum of the outer surface in the region of the graft is separated well over the upper and lower edges of the rib. It is now but a moment's work with the elevator to separate the periosteum from the entire inner surface, so that the rib shears passing between bone and periosteum never come in contact with the pleura.

It is my practice never to permit the graft to be touched by the fingers, either gloved or otherwise, nor is it permitted to come in contact with the edges of the wound while being introduced into the nose. By this, I am certain, infections are avoided. No difficulty has been experienced in trimming the graft any shape desired, with bone shears and heavy scalpel, when it is placed on a table covered with sterile towels and firmly held with bone forceps or in sterile gauze. To introduce the graft finally it is placed in a long speculum, a modification of Killian's for rhinoscopia media (Fig. 5). The speculum containing graft is introduced through the incision in the left vestibule, and passed upward all the way to the frontal notch. Pressure on the graft is now released with set-screw of the speculum, and graft pushed home with a pair of forceps as the speculum is withdrawn.

After placing graft in the exact position desired, the wound through which it is introduced is sutured with black silk. For all suturing within the nose the small, curved Riverdin needle has been indispensable. It must be borne in mind, as stated in previous papers, that undermining of the skin of the nose and preparation of the bed for graft is done through this incision in the wing, preferably through the left vestibule.

Another observation of importance is that, since contraction follows in the wake of every

incision made through the wing cartilages, it has been found best for the ultimate cosmetic effect to make similar incisions in both wing cartilages, though incisions on one side would suffice for the actual operation, so that contraction when it occurs will be equal on both sides, and not disturb the symmetry of the nose.

Much has been said about the relative value of the large and small incision through which the graft is introduced, and also of the dangers of infection where large incisions are made. My preference always is an incision of sufficient length to permit absolute freedom of action, always feeling assured that, with perfect technique, infection of graft is unlikely to result.

The graft is held in the mid-line of the nose by means of the copper splint which, when properly strapped with adhesive, also holds the graft in such intimate contact with the nasal bones that bony union has not yet failed to occur in any of my cases.

In saddle noses, following septal abscesses where the loss of the entire quadrilateral cartilage has taken place, it is necessary that some sort of support be furnished in its stead, to prevent a tipping downward of the lower end of the graft. This support is supplied by the introduction of a thin section of costal cartilage, of desired shape, which rests on the anterior nasal spine below and against the dorsal graft at the tip above (Fig. 6). It has been my custom to prepare a bed for this graft, under local anæsthesia, before ether is given to remove the rib and prepare bed for the dorsal graft. In this manner one avoids the obstacle offered by hæmorrhage, which at times is so profuse under ether as to obscure the field of operation and to render likely a buttonholing of the septal flaps. Should buttonholing of the flaps occur, infection of graft is almost certain to follow.

Fig. 11. Case 5 before and after operation.

CASE 4. Female, age 30. Congenital saddle nose. The bridge in the region of the notch was so flat that it was impossible for her to wear eyeglasses. A section of the entire rib was used in this case. Operation was performed 14 months ago. After-picture taken 3 weeks ago. Graft in excellent state of preservation.

CASE 5. Female, age 19. Acquired saddle nose, following septal abscess 4 years before. The entire septal cartilage was destroyed, and the resulting contraction caused an enormous depression. A dorsal graft of the entire thickness of the rib, with cartilage at its lower end, as well as a septal graft of costal cartilage was necessary in this case.

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BONE SURGERY OF THE NOSE[1]

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NASAL deformities of whatever description are due to or are accompanied by abnormalities or irregularities in the shape, size, or position of the bony and cartilaginous framework of the organ. The function may be disturbed or the skin of the nose may be involved in various ways, but these are accompaniments to the much more important basic fault which lies in the framework. Upon our ability to reconstruct this or to adjust its component parts so that it will support the soft tissues and preserve the contour of a normal nose, depends the success or failure of our efforts to effect a permanent correction. I say permanent advisedly, because we all know that sometimes a misshapen nose may be forcibly mobilized and molded into perfect shape by means of splints, but if the correction does not involve the proper adjustment of the framework, the original deformity recurs with incredible celerity after these supports are removed.

My work has been confined to the human subject and, therefore, I have been unable to observe to any extent the microscopical changes occurring in bone and cartilage after transplantation, but I have kept some of my patients under observation for many years, for I began this work nearly 15 years ago, and by making frequent physical and X-ray examinations, I have found out what final clinical results may be expected, and I know from a practical point of view what happens to bone and cartilage when it is transplanted into the nose.

The subject, "Plastic Surgery of the Nose," is too broad and general, and I find myself unable to discuss, within the allotted time, more than one phase of the subject; so I will confine my remarks chiefly to bone transplantation and those basic principles which, as I have stated, furnish the keynote to all plastic surgery of the nose.

From a practical, mechanical, and architectural point of view, the nose is an arch composed of an indefinite number of bone and cartilage segments so placed that it will retain its shape and position when supported only at its extremities. The upper edge of the septum, where it is wedged in between the lateral cartilages, constitutes the keystone of the arch. The displacement or destruction of this or any of the other segments causes more or less collapse of the structure, resulting in a flattening of the curve and the re-establishment of the arch on a lower level. The septum, as a vertical support, strengthens the arch but is not necessary for the preservation of its integrity.

In recent fractures and in old traumatic deformities where there has been no loss of bone or cartilage, I am still using the bridge splint, which I devised a number of years ago and with which you are all familiar. This instrument holds the segments of the arch in proper position until union has occurred.

The most frequent use for bone and cartilage transplants in rhinological surgery is found in those cases where a deficiency in the frame work has resulted in a depressed deformity which may involve the tip as well as the dorsum of the nose. The most frequent causes of this deformity are: (1) congenital defects; (2) traumatism; (3) the submucous operation, due either to faulty technique or infection following the operation; (4) abscess of the septum; (5) atrophic rhinitis; (6) syphilis, tuberculosis, lupus, etc.

We must remember that the function of the transplant is not primarily that of a mechanical filler to replace tissues that have been destroyed; this is a secondary, though often an important consideration from a cosmetic point of view. Our chief concern is to restore the function and symmetry of the nose to their normal state by constructing a framework of normal tissues that shall be capable of supporting the soft structures of the nose in their proper position, and to do this if possible without leaving an obvious scar. In order that this correction, primarily secured, may be permanent and able to withstand the powerful influence of cicatricial contraction and elasticity of the skin, which must always be reckoned with, the foundations for the new framework must be carefully selected and the transplants accurately placed upon them. The bone graft must be alive and capable of growth and must establish bony union with the adjacent bones in its new position. The best results are secured by using autogenous, periosteum-covered transplants and placing them in contact with live bone, the periosteum of which is elevated at the point of contact with the transplant. Bare bone is useful for its mechanical and osteoconductive properties and, even if it is later absorbed, it is replaced by bone or connective tissue and the results are more or less satisfactory. It does not,

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Fig. 1. Congenital specific deformity at left, before operation. At right, deformity corrected by bone transplant (strut operation). Photograph taken 1 year after operation.

however, possess the inherent vitality of the periosteum-covered transplant.

It is not my purpose to discuss here the various views held by different writers in regard to the growth of bone and the influence of the periosteum in the regeneration of bone. My clinical cases appear to show that bone is formed by the so-called periosseous osteogenetic layer of the periosteum, and that the cells of this layer are protected and their growth limited by the connective-tissue layer of this membrane; this envelope being comparable to the limiting fibrous capsule which separates all highly specialized tissue, such as the liver, kidneys, etc., from the surrounding structures.

The vigor of the transplant is greatly augmented by placing it in contact with live, periosteum-covered bone. In none of my cases has there been an overgrowth of bone, the normal growth of the tissues here, as elsewhere in the body, being regulated by the functional demands and by the hereditary limits of growth for this locality. On the other hand, if the transplanted tissue lies passive and performs no function, it is soon absorbed, even though it had been received kindly by its host and had originally established vascular connections. This is in accordance with the physiological law that functionless tissues meet with no tolerance in the human economy.

For transplantation into the nose, I still use a section of the eighth or ninth rib and costal cartilage, removed at the time from the patient's right side. I have previously described my operation, but I feel that I am justified in briefly reviewing this for the sake of favoring the interpretation of my illustrations and to call attention to some modifications and improvements I have made in the technique. The patient is etherized and turned on the left side with a sand bag support under the lower chest wall. After the initial painting of the operative field with iodine, only freshly sterilized, physiological salt solution is used. All antiseptics, such as bichloride, alcohol, etc., are carefully avoided, as they are protoplasmic poisons and would cause the death of the transplant. A section of the rib, 2 inches long, is removed, the periosteum on the outer surface being preserved. If it is a case in which it is considered necessary for the transplant to extend into the tip, I remove the section at the costochondral junction, and have the graft consist of two-thirds bone and one-third cartilage. This preserves the resiliency of the tip. In some instances I remove only the outer half of the rib, but where I expect to need more than one piece, I do not hesitate to remove the entire section. There is no loss to the chest wall, for the deficiency is filled in with bone, in some instances, 2 months after the operation. The section of rib is split and the cancellous tissue scraped off with a curette. I prefer thin transplants and sometimes introduce several in preference to one thick piece, as the viability of the transplant varies in inverse proportion to its bulk.

The nose is then prepared for the reception of the graft. A small incision, through which all of the work is done, is made in the roof of the left nasal vestibule. (I have long since abandoned my original external operation.) The periosteum over the nasal bones and the nasal process of the frontal is elevated, and an incision made into the latter for the reception of the upper end of the graft. The subcutaneous elevation of the tissues extends over the nose and in some instances for a considerable distance under the cheeks. The transplant is then carefully placed in

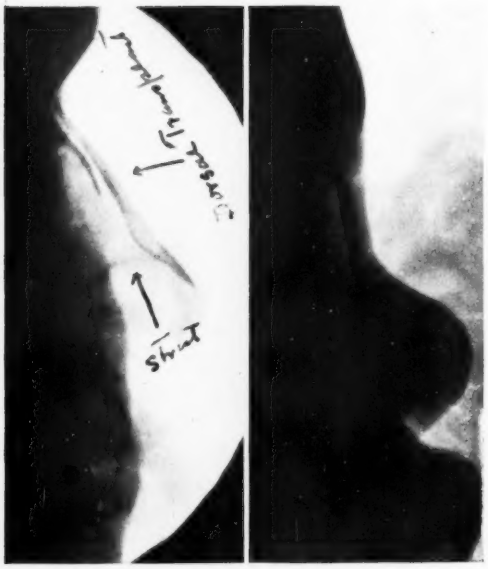

Fig. 2 (at left). Shows arrangement of transplants in strut operation as done in illustrated case. Note excessive growth in dorsal transplant where it comes in contact with the supporting strut.

Fig. 3. Bone transplant 6 years after operation.

position. No effort whatever is made to expel the blood clots, for this pabulum temporarily nourishes the transplant and the fibrin of the clot greatly favors osteogenesis. The entire nose is immobilized by means of a well-padded, tin-lined copper splint. In those cases where the traumatism has necessarily been great and the hæmorrhage considerable, I use my hot water jacket for the first 24 hours. This limits the swelling, aids in the establishment of the capillary circulation and diminishes the subsequent ecchymosis.

Under favorable conditions, in a healthy young subject, a bone transplant establishes firm, bony union with the frontal bone in about 2 months.

In cases where the tip is unsupported or the nasal bones are absent or collapsed and afford no fulcrum for the transplant, I introduce between the columnar cartilages a strut, composed of either bone or cartilage. The upper end of this strut rests under the lower end of the transplant and the lower end is anchored to the nasal spine of the superior maxilla. I have found this modification extremely satisfactory and use it in many of my cases. It insures the elevation of the lower end of the transplant and enables it to withstand the drag of cicatricial tissue and the elasticity of the skin.

Our object is to secure permanent results, and these are dependent upon the histological or pathological changes that occur in the transplanted bone. A discussion of this subject does not come within the scope of this paper. There is considerable difference of opinion, and I do not believe that the question will ever be settled definitely from the pathologist's point of view, for not only do results vary with varying technique, but it has even been found that among operators employing the same technique, the difference in personal equation produces diametrically opposite results. In my opinion the difference in results is caused: (1) by the inclusion with the transplant of more or less of the periosseous osteogenetic layer of the periosteum; (2) by infection at the time of operation; (3) by injury to the transplant in handling or from heat, antiseptics, etc.; (4) by differences in tissue metabolism of the host.

In syphilitic subjects, during the active stages of the disease and while they are Wassermann-positive, bone transplantation is not to be considered. I have secured good results in selected cases where the patient was apparently well of his disease and was in excellent physical condition. Here, in addition to the unusual severity of the deformity, and the large amount of cicatricial tissue, which is always present in these cases, we are contending with perverted metabolism, and a bone transplant is exceedingly sensitive to this. In specific cases one should always be guarded in his prognosis even under the most favorable conditions.

If the wound becomes infected a part or all of the transplant will die. If the infection is controlled without having to remove the graft, the dead portion will be absorbed. The periosteum is far more resistant to infection than bone. I have known the periosteum to establish vascular connections with the surrounding tissues and remain *in situ* after the removal of the dead graft.

Strict asepsis is essential in this work, for no progress was made in the transplantation of bone until after the introduction of aseptic surgery. No matter how slight the infection may be, a considerable absorption of the graft will occur. While the established immunity to the flora resident in the nasal cavities, the abundant blood supply of the part and the antiseptic qualities of the nasal secretion are factors in our favor, still we must not place too much reliance upon them, but must make every effort to secure a clean field.

I have had fewer infections since I adopted the intranasal route for the introduction of the transplant.

I have used cartilage to a considerable extent in the correction of minor deformities and irregularities and as a support where cartilage is normally present in the nose. I have secured excellent results in cases of collapsed alæ by grafting thin strips of cartilage into the wings. The use of gold-wire splints, as recently advised by me, after intranasal plastic operations, has added greatly to the efficiency of this operation. Cartilage is viable and is permanent and is more easily shaped to fit the deformity, but it never establishes osseous connection with the frontal bone, but remains always movable.

In conclusion I will say that in my opinion, based upon my own operative and clinical experience, the live, periosteum-covered autogenous bone transplant combined with cartilage when indicated is the ideal tissue for use in the correction of this difficult class of nasal deformities.

SECONDARY PERINEAL REPAIR

Description of a Simple Technique

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Of recent years there have appeared many descriptions of operative procedures for the secondary repair of perineal lacerations; it would, therefore, seem superfluous to add another technique to an already overstocked literature, especially as there is no great originality expressed, only, as the writer believes, an improvement upon the usual operations. The only extenuation that is made for this contribution is the simplicity of the performance and the correction along anatomical and pathological lines of a condition that is all too common.

In order to justify an operative procedure of this nature, a brief description will be made of, first, the anatomy of the pelvic diaphragm; second, the mechanics of the birth injury; third, the mechanics of repair by operation.

ANATOMY

The pelvic, or lower abdominal, diaphragm consists of a sheet of muscular tissue enclosed in a fibrous sheath, stretching across the bony outlet of the pelvic canal. The outlet of the pelvis consists of two triangular areas, the bases of which have a common line drawn from one tuberosity of the ischium to its fellow on the opposite side. The anterior segment has its apex at the pubic symphysis and its sides are the descending rami of the pubis. The posterior segment has its apex at the coccyx and its lateral boundaries are the ascending rami of the ischium. These two triangles are on two different planes. With the patient in the dorsal position the anterior one runs at right angles to the horizontal plane, the posterior one at an angle of 45 degrees. These facts are more of obstetrical value in the mechanism of delivery in outlet contractions, yet they have an anatomical bearing upon the causation of some of the perineal lacerations.

The muscles that bridge across this opening, making the pelvic diaphragm, are the levatores ani and the coccygeus. The levatores ani muscles are two fan-like structures having their origin from the posterior surface and lower border of the symphysis pubis, and extending backward on a line from this point to the spine of the ischium. This latter line of origin is the so-called "white line," which is thickened fascia—being the line of division of the obturator fascia into rectovesical and anal. The muscular fibers from the posterior and mid point converge in a fan-like manner to be inserted into the rectum. The anterior fibers arising from the posterior surface of the symphysis pubis form a sling that descends behind the descending rami, encircles the introitus and vagina, and are inserted into the rectum and coccyx. It is this latter bundle of muscles that has been named the puborectalis, or coccygeus, and which is subject to injury during delivery.

The fascial sheath of the levatores ani muscles consists of the rectovesical fascia upon its upper surface, and the levator or anal fascia on its under surface. As pointed out by Haynes (1), this sheath has the important function of reinforcing the muscles and binding the muscle fasciculi together in a compact manner, and aids

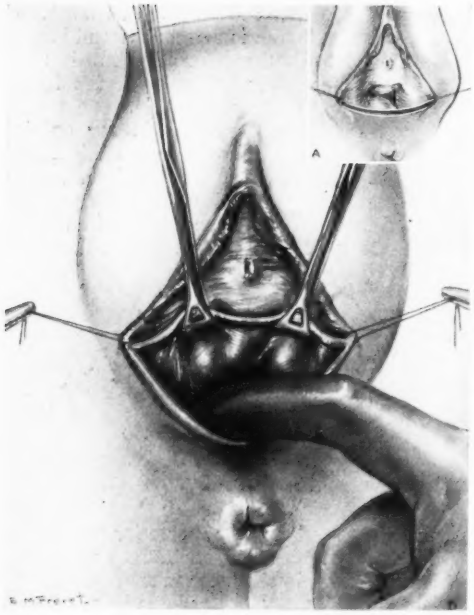

Fig. 1. a, Steps 1 and 2. b, Step 3. The index finger of operator's hand is shown making traction upon anterior rectal wall, thereby bringing the right puborectalis muscle into view.

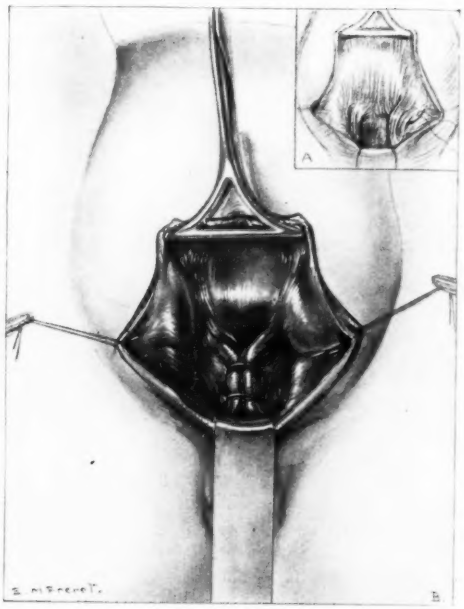

Fig. 2. a, Shows placing of suture through right puborectalis muscle and sheath. b, Shows the two chromic gut interrupted sutures in both muscles. This procedure ends Step 4.

it materially in performing its function of maintaining the support of the pelvic and abdominal organs. According to Frank (2) these fascia blend at the anterior border of the puborectalis portion of the levator ani.

The coccygeus muscles are two small triangular muscles that fill in the gap posteriorly between the spine of the ischium, the sacrosciatic notch and ligament, and the coccyx.

The next structure of importance in the anatomy of the perineum is the trigone or triangular ligament. This is a fibrous membrane attached to the bony boundaries of the anterior segment of the pelvic outlet. It is triangular in outline. Its base stretches across from each tuberosity of the ischium in front of the anus, its apex is attached to the pubic arch and subpubic ligament, and its sides to the descending rami of the pubis in front of the puborectalis muscle and sheath with which it is in intimate contact. This membrane consists of two layers between which runs the deep perineal muscle. There are two openings in the trigone—the urethra and the vagina—to which each is intimately connected, and to them it gives support.

It can readily be seen that the trigone plays an important function in the support of the urethra and vagina and gives secondary aid to the levatores ani muscles in maintaining its usefulness as a lower abdominal diaphragm, and perineal support of the anterior segment of the pelvic outlet.

THE MECHANISM OF BIRTH PERINEAL INJURIES

In a normal delivery following complete dilatation of the cervix and rupture of the membranes, the presenting part of the fœtal ovoid is propelled downward by expulsive voluntary abdominal contractions and uterine contractions to the pelvic diaphragm. That part of the fœtus which comes first in contact with this structure is rotated anteriorly directly under the pubic arch, and this acts as a fixed point or fulcrum. By a continuation of the expulsive forces, the posterior portion of the presenting part is propelled in an upward and outward direction, distending the posterior segment of the pelvic outlet and gradually thinning out the pelvic diaphragm, and produces a bulging of the perineum. This is the beginning of the perineal stage. As labor

progresses the presenting part appears at the vulva outlet and the structures of the anterior segment of the pelvic outlet (puborectalis muscles; trigone and other perineal muscles) are gradually more distended at each expulsive effort until the presenting part is born.

In a normal delivery where there is no disproportion between the fœtus and pelvic outlet, and in a patient possessing elasticity of the puborectalis muscles and triangular ligament, delivery can be accomplished without damage to these structures. Superficial lacerations, nevertheless, may occur that do not interfere with the integrity of perineal support.

However, instances exist many times in which there is disproportion between the fœtus and pelvic outlet in varying degrees. In order to overcome this obstacle, and for delivery to take place spontaneously, it is necessary for the expulsive pains to be of greater force and over a longer period of time. Under such circumstances inertia frequently occurs and the accoucheur resorts to forceps to accomplish delivery. The posterior segment of the outlet, as pointed out by Klein (3) and later by Williams (4), is markedly encroached upon and great distention of the perineal structures occurs in order to accomplish the desired end. Deep lacerations usually take place, at times in the median line through the trigonum down to, and occasionally through, the sphincter ani, producing a complete laceration. More often there are lacerations laterally in the vaginal sulci, which may or may not involve the puborectalis muscles.

In elderly primipara and among the athletic types of women, the perineal structures may be unresisting and non-elastic. Lacerations of the perineum frequently occur with this class. Median or lateral periniotomy, however, may prevent a severe or awkward laceration.

During the course of any delivery, an emergency may arise that makes it imperative to terminate labor by forceps or version before the presenting part has reached the perineum and without the preliminary softening and thinning out of the pelvic floor. Under such circumstances deep lacerations are common—involving the puborectalis muscles and triangular ligament, and often through the sphincter ani.

When the puborectalis is lacerated through, the site of the tear is usually along its insertion into the rectum. Instances are related where the muscle has been torn from its point of origin behind the symphysis pubis. I have never seen such a condition and the recognition of such an accident would be very difficult to determine.

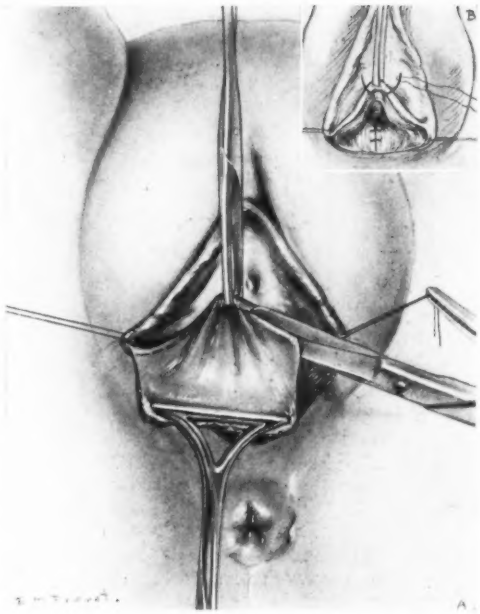

Fig. 3. a, Shows method of excising excess of vaginal mucosa. b, Shows beginning of submucous suture.

When perineal lacerations occur, the primary suture of the injured structures, if done anatomically and under proper conditions, will, in the majority of instances, prove successful in its repair. Unfortunately the proper environment and aid are frequently lacking when attempting this operation. Therefore, failures occur often.

Following an improper suturing of the lacerated puborectalis muscles or muscle, and a similar injury to the triangular ligament, we have a union, as a rule, of the vaginal mucous membrane and, if the perineal skin has been sutured, union has taken place there. The edges of the puborectalis, however, have retracted laterally from its rectal insertion, allowing the rectum to protrude through the posterior vaginal wall. Improper union of the triangular ligament in a similar manner causes a relaxation of the structures that depend upon it for support, then follows an eversion of the vagina, and relaxation of the vaginal outlet and a general lowering of tone of the whole perineal body.

Another class of cases includes the women who have had numerous deliveries in a short space of time; one child follows the other before complete perineal involution has occurred. When such a condition exists the puborectalis muscles and the

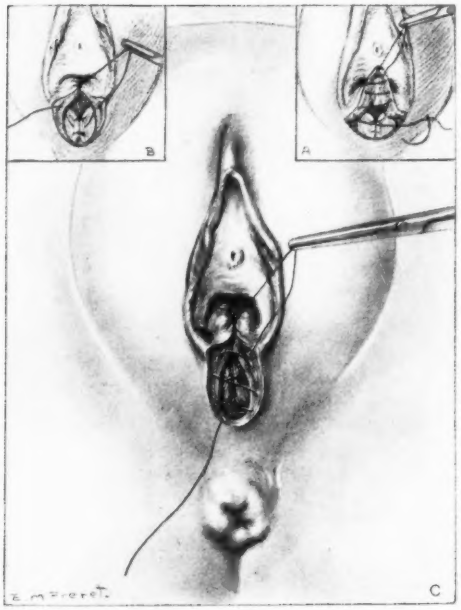

Fig. 4. a, Showing the submucous suture completed. b, Shows previous suture pulled tight with approximation of mucous membrane edges and with same suture of catgut, the placing of suture through the angles of the triangular ligament and mid portion of the approximated puborectalis muscle. c, Showing continuous suture of the triangular ligament to its lower angle. Completing steps 6 and 7.

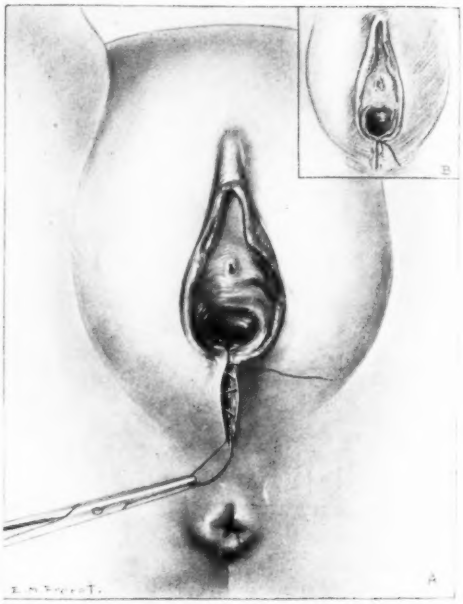

Fig. 5. a, Placing of subcuticular suture from lower angle of skin wound to the mucous membrane. b, Shows suture made taut with approximation of skin edges.

triangular ligament become stretched and thinned out, and separated from their insertion, and their normal elasticity and anatomical relationship become lost and distorted. This results in a general relaxation of the entire pelvic outlet, producing rectocele, eversion of the vaginal outlet, and protrusion of the vaginal mucous membrane. Other pathological conditions may also arise, such as cystocele, retrodisplacements, and partial uterine prolapse.

THE TECHNIQUE OF PERINEAL REPAIR

The modern operation for perineal repair was originated by Haynes in 1908 (5), who described a technique in which he localizes the anterior muscular bundle of the levator ani muscles (puborectalis) and approximates them by suture in the mid line anterior to the rectum. Further interrupted skin perineal sutures approximate the edges of the triangular ligament. Since that time many modifications and improvements upon this original technique have been described.

The following operative technique is one used by the author in over 50 cases with most satisfactory results.

Step 1. Patient in dorsal position with legs in stirrups. Place towel clamps or suture at the mucocutaneous junction of the vulva at openings of the Bartholin ducts. Make traction upon the clamps so producing a horizontal line between these two points.

Step 2. Grasp the mucocutaneous junction with mouse-tooth forceps and, with curved scissors, cut away a strip of skin and mucous membrane between each fixed point. This separates vaginal mucous membrane from the skin perineum.

Step 3. Make sharp scissors dissection of vaginal mucuous membrane taking particular care to have it very thin without buttonholing it. When a sufficient amount has been dissected from the underlying structures, place two triangular clamps upon it to facilitate further dissection. From now on, if a line of cleavage has been found, blunt gauze dissection of the vaginal mucous membrane is carried out to the dome of the rectocele, usually a distance of 1.5 to 1.75 inches.

Step 4. Make lateral gauze dissections of mucous membrane behind the descending rami of the pubis, in order to expose the puborectalis muscles and sheath. The edges of these muscles can be brought into view by placing index finger in the denuded area and pressing downward and backward upon the anterior rectal wall. We now have exposed the denuded flap of vaginal mucous membrane above; below, the anterior rectal wall; and laterally, the edges of the puborectalis muscles and fascial sheath situated behind the descending rami of the pubis. Place two interrupted No. 2 chromic gut sutures through these muscles and tie, thus approximating the muscles in the mid line anterior to the rectum. If any undue tension is present after tying sutures, this can easily be relieved by partially separating them bluntly from their attachment to the rami of the pubis.

Step 5. Excise Λ-shaped portion of the excess of vaginal mucous membrane and approximate edges by a continuous submucous suture until the cutaneous junction is reached. This suture is of No. 2 chromic catgut and over 20 inches long, and is used to complete the remainder of the suturing to be done. There is now a space bounded posteriorly by the approximated levator muscles, above by the approximated vaginal mucous membrane, and anteriorly by the cut edges of the triangular ligament and skin perineum.

Step 6. To obliterate this dead space and bring the normal relation of the triangular ligament in contact with the levator muscles and sheath, the suture is passed through the upper left angle of the triangular ligament, then through the mid portion of the approximated levator muscles, and through the right upper angle of the triangular ligament. By making this suture taut the desired effect is accomplished.

Step 7. The same suture now approximates the edges of the triangular ligament with several bites until its lower angle is reached.

Step 8. The same suture now approximates the skin perineum, beginning at the lower angle using it in a subcuticular manner back to the mucous junction where two slip knots are made, burying them beneath the mucous membrane.

SUMMARY

1. The structures injured at the completion of the second stage of labor producing subsequent relaxed perineum, rectocele, are the pubococcygeus muscle bundles of the levatores ani, their fascial sheath (rectovesical and anal fascia), and the triangular ligament.

2. In order properly to correct the disturbed anatomical relationship of the puborectalis to the rectum, it is necessary to approximate them with their fascial sheaths in the mid line anterior to the rectum.

3. To restore the vulva and vaginal support which depends upon the triangular ligament, it is necessary to shorten this structure and place it in close contact with the levator muscle and sheath.

4. The operative technique described above fulfills these conditions in that it re-establishes the perineal structures in their anatomical relation.

5. The use of a submucous suture in approximating the resected vaginal membrane prevents pain from tension and irritation from a leucorrhœal discharge that always follows the absorption of sutures taken through the mucous membrane. The subcuticular suturing of the skin perineum also prevents tension upon the skin, and precludes the possibility of infection through needle openings.

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A NEW SPLINT FOR FRACTURES OF THE FOREARM[1]

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FRACTURES of both bones of the forearm are the most poorly treated of all fractures in the body. The methods of splinting now used have been in vogue for many years, and while known to be inadequate, have never been improved upon. The late war taught us an efficient and easy method of splinting fractures of the lower extremity, and as a result we have discarded to a large degree the older methods. The Liston splint, Buck's extension, and many of the cumbersome and unwieldy forms of apparatus advocated by the German surgeons have been supplanted by the more modern splints of wire and steel rods, and for weight and adhesive traction we now use direct bone traction by means of the tongs and the Steinmann pins. The war has also taught us that it is not necessary to bind up a fracture in boards with an artistically arranged bandage, and has dispelled the old misplaced complacency we formerly felt in a fine appearing external dressing. For fractures of the upper extremity, and especially those of the forearm, we have no adequate and efficient traction splint. For forearm fractures the anterior and posterior straight board splint is our only generally recognized dressing.

Fracture of both bones of the forearm is a rather common injury, occurring as it does in about 8 per cent of all fractures. Brun reports out of a total of 8,560 fractures, 752 of the forearm or about 8.7 per cent; Chudowsky of a total of 2,366 reports 125 fractures of the forearm or 5.32 per cent; Immelman in 2,048 fractures reports 7.5 per cent of the forearm, and Plagman reports 9.62 per cent. This fracture, therefore, is common enough to merit more attention in treatment than it now receives. It occurs in the young most frequently, the deformity is usually a lateral or backward angulation, the dorsal surface of the forearm forming an obtuse angle, and the ventral surface forming the salient angle.

Reduction under general anæsthesia, even when checked up by the fluoroscope, is most difficult. The muscular masses are out of proportion to the size of the underlying bones, the muscular pull is in many diverse planes, the bones are small and the ends are usually pointed or oblique. The radius is especially difficult to engage; it is usually fractured in an oblique manner, and even though it is reduced, to keep it in position with wooden splints and without traction is next to impossible. There is no fracture where the ultimate resort to operation is so frequent or where the results are so poor. As the bones are so near to the skin surface, infection is very frequent, plates loosen, and deformity occurs.

The splint I have devised for this fracture is a metal tube splint. It is an ambulatory dressing. It is light in weight and is inconspicuous. The posterior two-thirds is made of light tube steel with two lateral arms and a posterior cross piece. The anterior one-third is made of a steel rod, the anterior end of which is expanded into a large ring. The rod fits into the tube portion of the splint like a sliding trombone and can be extended by two screws or turn-buckles traveling on the threaded anterior portion. A removable aluminum shield is clamped to the tubing and is set at such an angle that it impinges on the anterior surface of the upper arm with equal pressure at all points. The hand is tied to the expanded circular anterior portion of the splint by means of cords fastened to the fingers of a glove buckled about the wrist. The shield, well padded, is applied to the anterior surface of the upper arm, which has been flexed to a right angle, and held with adhesive plaster. The turn-buckles are then tightened, and traction and counter-traction are maintained with the arm in full supination.

If it is desirable to dress the arm in the mid-position midway between supination and pronation, a small rod is dropped into a ring on the anterior part of the splint at right angles to the horizontal plane of the splint, and the cords are attached to this rod.

The same splint may also be used for fractures of the humerus when dressed in full extension.

Fig. 1. Photograph of splint.

[1]Demonstrated to American College of Surgeons, Philadelphia, October 25, 1921.

Fig. 2. Splint applied to arm.

For this class of cases, the shield is removed and the expanded anterior section of the splint is fitted over the shoulder and a heavy pad placed over the acromion process. The glove-encased hand is attached to the posterior cross bar and the splint is extended by the turn-buckles. The arm may be maintained in this position under constant traction until reduction is obtained, and then the more comfortable position of flexion may be used. As the point of fixation, when the splint is applied in this way, is a bony one there is no danger of pressure on either nerves or blood vessels, as occurs in splints with a crutch attachment and where the point of pressure falls in the axilla. The splint is held in place by swathes which are placed about the chest and neck.

Fig. 3. Arm flexed.

The advantages of the splint are that—

1. It is light and comfortable.
2. It leaves the part open for massage and inspection without disturbing the constant traction.
3. Constant graded traction is maintained at all times and can be increased or decreased by the patient if too uncomfortable.
4. The progress of the traction can be watched by the X-ray.
5. It can be used for more than one type of fracture.
6. All points of pressure are free from nerves and blood vessels.
7. It is inexpensive and durable.

THE DIRECT STIMULATION OF PERIPHERAL NERVES

Rules for Procedure in the Operating-Room

By HENRY O. FEISS, M.D., Cleveland, Ohio

In a previous work in collaboration with two others,[1] a brief report was made on peripheral nerve injuries as studied during the recent war. In that report mention was made of the fact that during the operations on these nerves, they were almost always tested for faradic excitability. No detailed account of the method was given at that time, but owing to the fact that considerable interest has recently been awakened in certain operations applying to spastic paralysis, especially as carried out by Stoffel, the writer offers the following account of the method which was used by him on hundreds of wounded men, while he served in a neurological capacity at the American Ambulance before and after its militarization by the U. S. army. His experience is, however, not derived from the operating-room alone, but is also based upon certain experimental data obtained previous to the war.[2]

In stimulating nerves in the operating-room, one soon learns to establish a definite routine which resolves itself into a set of rules. No doubt there are certain deficiencies in those used by the writer, but they are presented for what they might happen to be worth and as they were actually carried out.

Rule 1. After a most careful dissection of the nerve, the surgeon should free it for a sufficient distance, depending in the individual case upon the conditions found locally in and about the nerve, but care should be taken not to "strip" the nerve clean for any greater distance than is absolutely necessary, as such a procedure injures the circulation in the sheath of the nerve.

Rule 2. During the unavoidable manipulation by the surgeon in attempting to isolate the nerve from the scar or other adherent tissues, responses might be evoked owing to the mechanical stimulation thus brought about. These should be carefully observed[3] all through the operation because the effects of mechanical stimulation of a nerve are of the greatest importance, especially when they are positive. Their importance lies, first of all, in the fact that one need not consider anything analogous to the escape of current, which complicates the use of electrical stimulation, as the stimulus is conveyed only by the one nerve handled. In the second place, these responses (obtained by mechanical stimulation), give us a very clear notion, from the point of view of conductivity, of the precise functional state of the nerve as well as of the muscles which it supplies because of the extreme delicacy of the test.

Rule 3. Before faradic stimulation, the nerve previously freed should be lifted up on a non-conductor hook, a glass hook being very useful. The object of this is to isolate it from all other tissues. If, however, the nerve is found divided, the advisable technique is to take a suture through the end of the segment to be stimulated and to lift it up in that way.

Rule 4. During the act of stimulation, the nerve should be kept moistened with warm salt solution. This is easily done by having the assistant moisten a sponge with the solution, squeezing it out drop by drop over the structure tested. Not too much solution should be dropped into the wound for fear that the nerve will lie in a bath of fluid, thus promoting spread of current.

Rule 5. For faradic stimulation, the bipolar electrodes are usually considered more practical than the unipolar ones (whereas in stimulating cortical areas, unipolar electrodes are better). The electrodes should be of metal all the way through, so as to be easily sterilizable. The points themselves had better be of platinum and should be constructed so that the distance between them may be altered with ease. It was found expedient to have the two platinum wires entirely free for a distance of about 1.5 centimeters, so that the distance between their free ends could be adjusted by simply bending the wires.

Rule 6. It is perhaps best to start with a current of only moderate strength. A strong current is dangerous on account of spread and should be used only on occasions where a weak or a moderate current has been previously tried. A good procedure is to test the current before the operation by applying the electrode points to the tip of one's tongue, a current which just begins to be

[1] Majors G. E. Price, H. O. Feiss and Lieutenant Terhune. Peripheral nerve injuries. Arch. Neurol. & Psych., 1919, 1, 547-559.

[2] H. O. Feiss. On the fusion of nerves. Quart. J. Exper. Physiol., v, No. 1.

[3] In all this work, the extremity of the limb to be operated upon should be as carefully sterilized as the field of operation, because it is necessary to expose the fingers and hand, or the toes and feet, in order to watch for responses in them.

perceptible, being a good current to start with on the nerve. This having been done, the relationship of the secondary coil to the primary coil is noted and maintained for the beginning of the operation. For thick nerves such as the sciatic or where there is much scar, a stronger current will be required, in order to insure that the inner central fibers are engaged in carrying it.

Rule 7. Stimulate the nerve on all its sides and if there is a neuroma, stimulate above and below the neuroma, as well as in the course of the neuroma itself. Remember, however, that the interesting portion of the nerve for efferent fibers is the segment peripheral to the lesion. For afferent fibers, the central segment is more important and one looks for responses in the pulse, respiration, pupils, skeletal muscles, etc.

Rule 8. If the response for efferent impulses is positive, the surgeon should attempt to separate the nerve into its constituent bundles and to test each bundle, one at a time. In this way he may be able to obtain precise information as to which part of the nerve has escaped injury or has regenerated. The surgeon should also examine the neuroma with the same object in view; namely, to see if there are any tracts which are excitable or conduct impulses.

Rule 9. It is important to note the precise nature of the responses; it is not enough to say whether the response is positive, but it is also necessary to describe accurately what the response is. For example: In stimulating the musculospiral nerve above the elbow, note whether the wrist extends and whether there is an extension of the fingers and thumb. More than that, note how great and how powerful the movement is. In stimulating the median nerve just above the wrist, this rule is of the greatest importance because the normal responses here are only of the thumb and two fingers and are not great in their extent, whereas, more central stimulation evokes responses which are more extensive and powerful. In some cases the muscles and their tendons contract, but bring about no movement of the joints to which they apply; this is owing to mechanical resistances as occasioned by contractions or ankyloses.

In stimulating the sciatic nerve, the interpretation may be difficult. If plantar flexion takes place in the ankle it must be the effect of stimulating fibers in the internal popliteal nerve. But we cannot infer from that, that the external popliteal nerve is out of commission because frequently the muscles supplied by the internal popliteal nerve have greater power than those supplied by the other. In order to determine the true condition of excitability in these two branches, one must either first separate them completely or stimulate each separately, well below the bifurcation.

Rule 10. The writer has usually started with slow interruptions in the current, not only because the effect of excitation may be better studied, but also so as to avoid fatigue. This rule is, however, subject to modification, and as it is known, from experiments on the vagus nerve, that some of its fibers respond better to certain given rates of interruption, it is perhaps better in some instances to try different rates of interruption.

Rule 11. If it is decided to exsect the neuroma, which is often found connecting the two segments of the lesion, it is of interest to study the extremity during the actual exsection because this act is nothing more or less than a form of mechanical stimulation. Therefore, when this is to be done one should be prepared to observe the effect; the neuroma should first be cut off from the central segment and secondly, from the peripheral segment. This may reveal a peculiar condition of conductivity in the neuroma. Occasionally it is found that on stimulating the peripheral segment, responses are obtained which were not obtained on stimulating the central segment. According to most physiological opinion, this means that fibers have grown down from above (in the central segment) and have indirectly connected with the peripheral segment through the scar tissue around the lesion.

It goes without saying that observations as made in the operating-room are valuable only if a careful examination of the part has been made beforehand and the last examination should have been made only a few days before the operation. If this is done, the data derived from direct stimulation of the nerve are adaptable to comparison with the data obtained previously by stimulation through the skin and should, of course, confirm these findings. Should there be any discrepancy, the data obtained by direct stimulation are to be considered the more accurate. But if the two sets of data correspond, then the whole set of findings becomes immensely more valuable.

INDUCTION OF LABOR BY THE USE OF CASTOR OIL AND QUININE

A Report of Three Hundred Cases[1]

By A. C. WILLIAMSON, M.D., Pittsburgh
Assistant in Obstetrics, Western Pennsylvania Hospital

THE attempted induction of labor by the use of castor oil and quinine is one of the commonest procedures in obstetrics. It is harmless, so that if it fails there is nothing amiss; if successful, labor has been inaugurated easily without undue distress to the patient or relatives and a more troublesome method of induction has perhaps been avoided. Occasionally it seems that abortions are brought about by the use of these same drugs. As early as 1890, Atkinson (1) in a court case, wherein it was contended that quinine had been the responsible agent for the abortion, asserted that there was some evidence for the assumption that quinine has an oxytocic effect, but that cinchona alkaloids had no fixed and definite action on uterine contractions, except in certain cases which appeared to have an idiosyncrasy toward the compounds.

Two cases have come under observation in which I feel that quinine and castor oil were responsible for the abortions. One case was that of a primipara 3 months pregnant. She took 60 grains of quinine sulphate over a period of 6 hours. She had marked signs of cinchonism and aborted with extreme pain, but at the end of the third day seemed to have recovered from all ill effects of the experience. The second patient was a multipara, 4 months pregnant. She took an ounce and a half of castor oil and forty grains of quinine. Her pains were sharp and she had profuse vaginal bleeding, suggesting an early separation of the placenta before the os was sufficiently dilated to allow the passage of the fœtus.

METHOD OF EMPLOYING THE DRUGS

The patients are allowed a light dinner and in the case of primiparæ, the oil is given at midnight, in multiparæ, at 6 or 7 o'clock in the morning. These hours are purposely chosen, for administration at such times usually means that the cases will be delivered during the daylight or seasonable hours. The oil, an ounce and a half, is given with orange juice or some other vehicle of a similar nature, to enable the patient to take it easily. A hot enema, 116° F., is administered as soon as the oil is effective. Directly after the enema, quinine sulphate is started in 5-grain doses, at 30-minute intervals and continued until 20 grains have been ingested. If the patient at any time complains of ringing ears or nausea, the drug is immediatly stopped. Usually if the quinine is given with a grain of pepsin there is no nausea. In a few of the cases reported, the quinine was given in 10-grain doses beginning with the effectiveness of the oil and then 2 hours later. I do not believe that the results justify the use of the drug either intravenously or intramuscularly. If the attempt failed, a second trial was never made until 10 days later. The age of the patient played no part in the question of the attempted induction.

	Age	Successful	Unsuccessful
Primipara	18–39	60	80
Multipara	21–43	80	80
Total		140	160

In the unsuccessful cases, all were due by date except 20 primiparæ, and the heads were fixed in all cases but 8. The induction was attempted early either because of a moderately contracted pelvis or an impending toxæmia. Of the multiparæ, all the cases were due by date with the exception of 28. The heads were not fixed in 20 cases, but the induction was employed for an impending toxæmia or because the case seemed well over due, even though the dates did not correspond.

DISCUSSION OF CASES

It will be noted at once that the percentage of successful induction is 46.6 per cent. This result corresponds closely with that of Muschallik (2) who reports 58.6 per cent in 155 cases using the drugs by mouth, and 52.2 per cent in 50 cases where the quinine was used intravenously and intramuscularly. It will also be noted that the positions and presentations apparently play an unimportant and negligible part so far as success is concerned.

There were 20 cases of fulminating labor, 4 primiparæ and 16 multiparæ. These cases, together with the number ending in operative deliveries, emphasize the fact that castor oil and quinine induction is not without its dangers. All patients were carefully observed in labor, and the fœtal heart counted at regular intervals. We immediately interfered at the first appearance of

[1] From the Department of Obstetrics, Western Pennsylvania Hospital, Pittsburgh, Pennsylvania; Clinic of Dr. Paul Titus.

fœtal or maternal distress. By fœtal distress we mean any change in the character of the fœtal heart, any sudden continued rise or fall in the count per minute, or any discharge of meconium per vaginam in presentations other than breeches. The term maternal distress is too evident to demand elaboration.

Among the unsuccessful cases, one, a primipara 20 years old, with the cervix partially taken up and the head fixed, deserves special mention. After the ingestion of 15 grains of quinine sulphate, she had marked aural and visual disturbance. Her uterus contracted at intervals, the pain being severe enough to distress and keep her from resting. The uterus did not relax well between pains and fœtal distress was apparant. The contractions lasted over a period of 4 hours, and the noteworthy facts were that as soon as the contractions ceased, the fœtal heart promptly became normal again and the cervix showed no change from that at the beginning.

This last fact is of interest because it bears directly on the question as to whether quinine in its action on the uterus ever has any effect on a closed cervix.

In the successful cases the noteworthy facts were: (1) the patient was due or past due by dates; (2) the head was fixed or was beginning to engage; (3) the cervix was partially or completely obliterated and the inner os would admit a finger; (4) the uterus was irritable and would easily contract under manipulation.

ACTION OF QUININE

The question immediately arises as to whether quinine is an oxytocic and acts directly on the uterine muscle or not. Clinically, for many years past, quinine has been used and still is used in uterine inertia, stimulating the uterus in some cases and failing in others. It is occasionally prescribed in menorrhagia but with no fixed results. Fischer (3) in discussing the use of quinine in malarial pregnant women, questions whether the drug has ever caused an abortion in such cases. He believes, however, that in non-pregnant women it may cause too frequent periods and excessive flow at regular periods. In the few patients he has treated with quinine for menorrhagia, the results have been gratifying but the few cases do not warrant the drawing of too definite conclusions.

The exact innervation of the uterus is not altogether definite. It has been repeatedly demonstrated in the laboratory that if the pregnant uterus is excised and then placed in Ringer's solution or any other physiological solution, the temperature kept constant at 37° C., labor will go on spontaneously until the end, even though the organ lacks all body connections. Cases are frequently reported, in which there are grave injuries to the spinal cord. Such patients have a noteworthy labor due to the fact that they experience no sensation of pain. A patient of this type was recently seen on the service, 7 months pregnant. She had a motor and sensory disturbance below the tenth thoracic, due to a transverse myelitis. She had no knowledge of the fact that she was in labor until after the fœtus had delivered. Such evidence makes it impossible to doubt that the intrinsic nerve supply of the uterus is sufficient to carry on labor independently of other external nerve supply. We cannot lose sight of the fact, however, that there must be a connection with the sympathetic system, for it is admitted that extreme emotion may profoundly influence the course of labor either by way of acceleration or retardation.

Guggenheim (4) has brought out an interesting fact concerning the effect of quinine on the uterus. He used uteri excised from rats for his experiments, placing them in Ringer's Solution kept at body temperature. When quinine was added to the solution he demonstrated two facts, namely: there was a definite increase in the tonus and rhythm of the contractions if present, though no contractions could be initiated if not already in action; the os, if not open and patulous, would remain unchanged no matter how long the fundus muscles contracted, in other words, a long cervix, closed and not taken up, would not be effected by the drug. This bears directly upon the question as to whether quinine can initiate labor or influence the condition of the cervix.

The most recent work has been done by Acton (5). He was especially interested in women who

	Time of Onset, Labor	Length of Labor	Cases
Primipara	2½ to 19 hours Average: 6 hours	6½ to 19 hours Average: 11 hours	60
Multipara	2 to 11 hours Average: 3 hours	2 to 11 hours Average; 6 hours	80

	Spontaneous Delivery	Forceps	Version	Pituitary Extract	Position			
					L. O. A.	L. O. P.	R. O. A.	R. O. P.
Primipara	32	28 { 20 Fœtal distress; 8 Delayed Second Stage }	0		40	4	12	4
Multipara	66	8 Fœtal distress	1	5: D.S.S.	52	12	12	4

were malarial and desired to know the effect of quinine medication upon the pregnant uterus. To make the conditions of the experiment conform as closely as possible to those existing when the drug is taken by mouth, the quinine was used in alkaline solution. It is probably true that the drug is carried in the alkaline bloodstream as a weak base and utilized as such, hence in experimenting an alkaline solution of the drug should be used. The experimenter took 5 grains of quinine sulphate by mouth and at the end of an hour found that the quinine concentration in his blood was 1:378,000 and at the end of two hours, 1:750,000. This fact would afford an accurate comparison in the use of experimental quinine. A quinine solution of 1:42,500 introduced into the Ringer's solution, containing the excised pregnant uteri, caused violent contractions, almost tetanic in character, while in a solution of 1:150,000 merely increased the tonus and rhythm of the contractions without any untoward effects of overstimulation.

In labor, the longitudinal muscle fibers of the upper segment act as a driving force in expelling the fœtus from the uterus, and synchronously with this contraction, the circular muscles of the lower uterine segment are relaxed and stretched to allow the head to pass through the low narrow segment of the uterus. In all his work, Acton noticed an effect of the quinine upon the muscle groups, but the os remained closed and unchanged and in exactly the same condition as it was before the addition of the drug. His conclusions are that concentrations of 1:150,000 increase the intermittent uterine contractions and if some exiting cause, such as a patulous or dilated os be present, the pressure brought by the increased contraction, in an already irritable uterus having slight contractions (the usual condition of uteri at or near term), it might be sufficient to cause the onset of active labor. He does not report the initiation of contractions if they were not already present. Such experimental work would lead one to believe that quinine is an oxytocic although it does not seem to have the power of initiating contractions. From a comparison of the experimental concentrations of quinine used and the concentration in the blood when the drug was taken it would seem that 20 grains taken at intervals by mouth would be sufficient to bring about the necessary concentration in the blood for definite action upon the uterus.

ACTION OF CASTOR OIL

Among the cathartics castor oil is one of the mildest. It has a definitely irritating effect upon both the large and the small intestine. As far as inducing labor is concerned, its direct action is questionable. The most probable explanation is that, in the irritation of the whole gastro-intestinal tract, it brings about peristaltic increase through its local action on the bowel. It may be parenthetically noted here that quinine also has a local irritating effect upon the intestinal tract. The disturbance from the increased peristalsis is transmitted to the sympathetic centers of the system controlling the intestinal tract. The uterine center, if there be such a thing, is situated near the other low sympathetic centers and is either directly or indirectly affected, thus setting up the beginning contractions in a near term and irritable uterus. This explanation is reinforced by the observation that severe diarrhœas in pregnant women frequently initiate labor. Probably the irritation of the castor oil starts the uterine contractions, the quinine then reinforces through direct action on uterine muscle steadying the rhythm and increasing the tonus.

CONCLUSIONS

1. Quinine and castor oil, in inducing labor, are successful in approximately 50 per cent of cases.
2. Labor should be carefully watched, for occasionally there may be tetanic contractions. At the first sign of fœtal or maternal distress, the operator should be ready to interfere.
3. If there are signs of cinchonism, the quinine is to be stopped at once.
4. The most favorable conditions for this type of induction are: when the estimated date is due or past, when head is fixed or beginning to fix in pelvis and when the uterus is irritable.
5. The mechanism is due to irritation caused by the castor oil on the sympathetic centers with increased peristalsis and a reinforcement of the rhythm and muscle tonus by the quinine acting directly upon the uterine muscle bundles.

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ULCERS ON THE POSTERIOR WALL OF THE STOMACH AND DUODENUM[1,2]

Symptoms, Diagnosis, Technique of Operation

By MOSES BEHREND, M.D., F.A.C.S., Philadelphia

No case of ulcer on the posterior wall of the stomach that came under our care was diagnosed as such until operation. The patients had symptoms of ulcer of the stomach, but the location of the ulcer was not accurately determined until operation. The symptoms of ulcer on the posterior wall of the stomach are not so well defined as are those of ulcer on the anterior wall. In cases of ulcer on the posterior wall, operation can be postponed longer than in cases afflicted with ulcers on the anterior wall or lesser curvature of the stomach. On account of this delay, ulcers on the posterior wall become much larger than those found in other parts of the stomach; they are not so freely movable and because of their adherence to the contiguous structures, their removal is much more difficult.

The diagnosis of ulcers on the posterior wall of the duodenum presents the same difficulty in formulating a diagnosis as to location as do those found on the posterior wall of the stomach. In the former the symptoms are more marked and the patients seek operative relief earlier. While it is not of paramount importance to know the exact location of an ulcer before operation, still one must be conservative regarding the prognosis after operation for ulcers on the posterior wall of the stomach and duodenum because such ulcers require more extensive operation and this entails greater risk.

The tissue surrounding an ulcer on the posterior wall of the stomach is usually so involved that at operation it is often impossible to tell whether the condition is benign or malignant. We have in a few instances pronounced ulcers malignant at operation, when much to our surprise the pathologist has reported them benign. Unquestionably cancer may follow ulcer of the stomach and of the duodenum but the writer has never observed a malignant ulcer of the duodenum or carcinoma engrafted on a duodenal ulcer. Cancer of the first portion of the duodenum is admittedly a rare occurrence, cancer of the second portion is more common, but not nearly so prevalent as cancer of the stomach. The occurrence of cancer engrafted on ulcer of

[2] Research work performed at the Baugh Institute of Anatomy, Jefferson Medical College. Clinical work performed at Jewish and Mt. Sinai Hospitals.

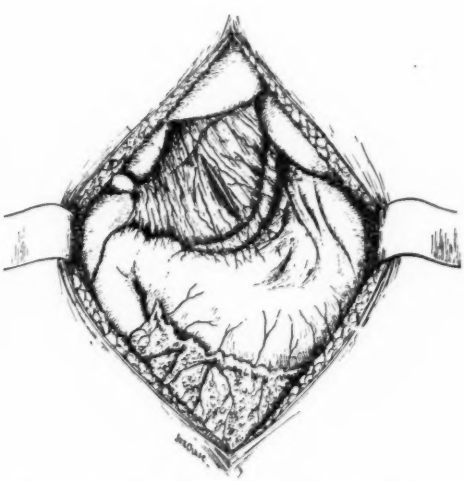

Fig. 1. Gastrohepatic omentum has been incised.

Fig. 2. Posterior wall of stomach has been delivered. Ulcer and portion of wall being excised with cautery.

[1] Read before the Philadelphia County Medical Society, October 12, 1921.

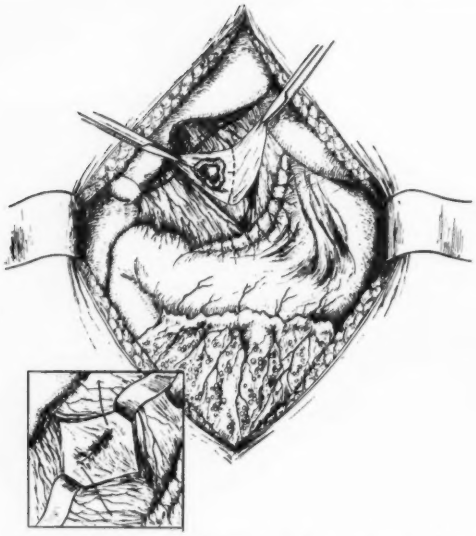

Fig. 3. Excision is almost complete. Insert shows stomach sewed opposite to the incision.

the stomach varies according to different observers. The range is from 7 to 62 per cent.

The X-ray discloses many ulcers on the lesser curvature and the anterior wall of the duodenum, and the method is fairly accurate, but this is not true in locating ulcers on the posterior wall of the stomach. Even with the patient in the lateral position, except in a few cases, it is impossible to detect an ulcer on the posterior wall of the stomach with the X-ray.

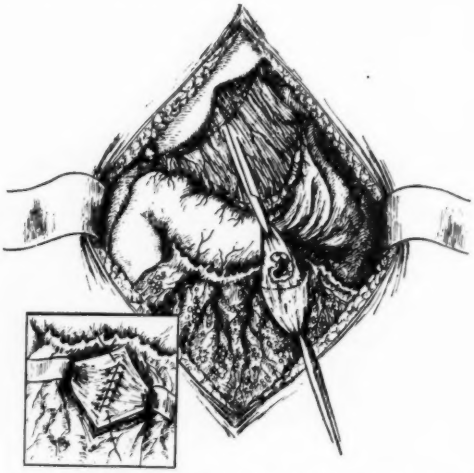

Fig. 5. The ulcer has been nearly all excised. Insert shows stomach sewed in the opposite direction to the incision.

As stated, the symptoms of ulcer on the posterior wall of the stomach do not differ materially from those on the anterior wall. The characteristic symptoms of "indigestion," pain immediately after eating, vomiting, and hæmatemesis usually stamp the condition as one of gastric ulcer.

Fig. 4. The gastrocolic omentum has been opened. The ulcer-bearing portion of the posterior wall of the stomach has been delivered.

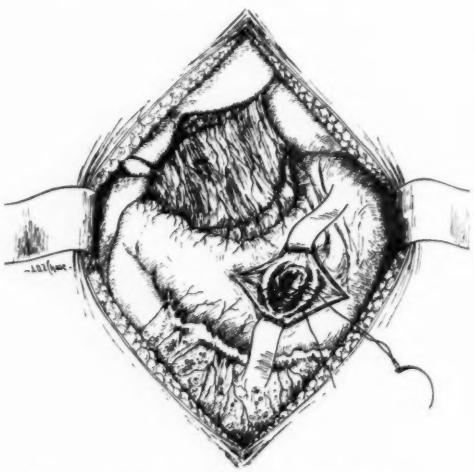

Fig. 6. Transgastric method of attacking an ulcer on the posterior wall of stomach. Note Lembert sutures in mucous membrane which, completed, cover the ulcer.

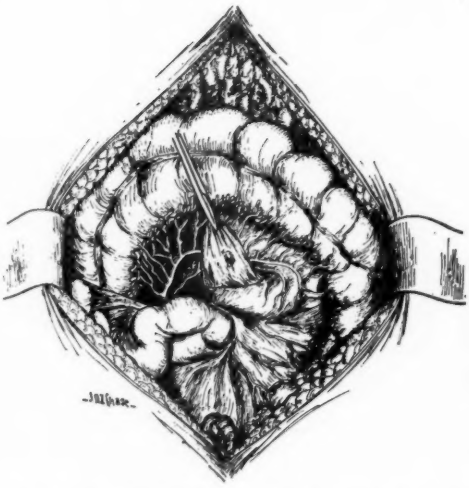

Fig. 7. The transverse mesocolon has been incised and ulcer, with posterior wall of stomach, has been delivered.

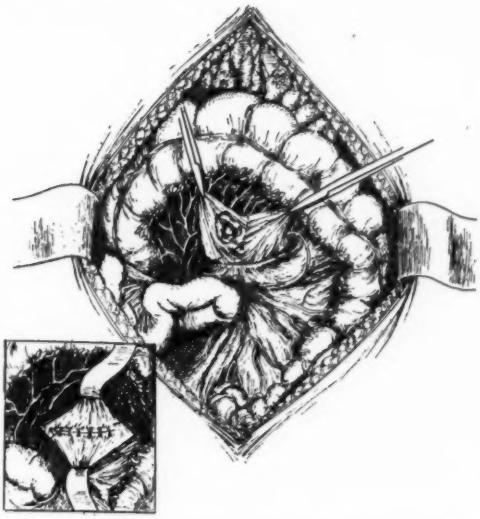

Fig. 8. Excision almost complete. Insert same as above.

The cardinal symptoms of duodenal ulcer do not differ even if the ulcer is situated on the posterior wall of the duodenum. Pain an hour or two after eating and relief after taking food are characteristic.

The diagnosis between ulcers of the stomach and duodenum and gall-bladder disease is simply mentioned to remind one of the possibility of mistaking these affections one for another.

ULCERS ON THE POSTERIOR WALL OF THE STOMACH

Ulcers on the posterior wall of the stomach may be approached from several anatomical landmarks. Some prefer attacking the ulcer through the gastrohepatic omentum (Figs. 1, 2, and 3); others select the gastrocolic omentum (Figs. 4 and 5), while the transgastric (Fig. 6), and transverse mesocolon routes (Figs. 7 and 8), may be the choice of other surgeons. In the writer's experience, it is not possible to treat all cases alike; some may be more easily removed by going through the lesser omentum, others again may be more easily removed through the greater omentum. If the ulcer is not adherent to underlying structures, the routes just mentioned are to be preferred, but if we encounter an ulcer that is firmly plastered to the parietal peritoneum, pancreas, and other vital structures, the transgastric operation has a distinct field of usefulness.

Briefly, the superior route consists in the following steps: The gastrohepatic omentum is incised, the right hand being employed to push the stomach upward until the ulcer is reached. The ulcer is then removed by means of the cautery, the stomach is sewed in the opposite direction so as to prevent encroaching too much on its lumen (Figs. 1, 2, 3, and insert). In the inferior method the gastrocolic omentum is incised, and the method of procedure is reversed, the left hand being used to push the stomach downward, and the ulcer is treated as mentioned before (Figs. 4 and 5). One of the best methods of attacking ulcers in this situation is the route through the transverse mesocolon. Here we follow practically the same procedure that one uses in performing a gastro-enterostomy. In performing operations in this situation, extreme care must be taken not to injure the middle colic artery.

The last method is preferable at times to the other two just mentioned because it affords ample room in which to work (Figs. 7 and 8).

The transgastric method of treating ulcers of the posterior wall has given considerable satisfaction. It is absolutely necessary at times to use this method on account of the close adherence of the ulcers to the posterior parietal peritoneum and contiguous structures. An incision is made on the anterior wall of the stomach, the edges are retracted, and the ulcer plicated, being completely covered by at least two rows of sutures.

Fig. 9. The duodenum has been mobilized and clamped. (Ochsner.)

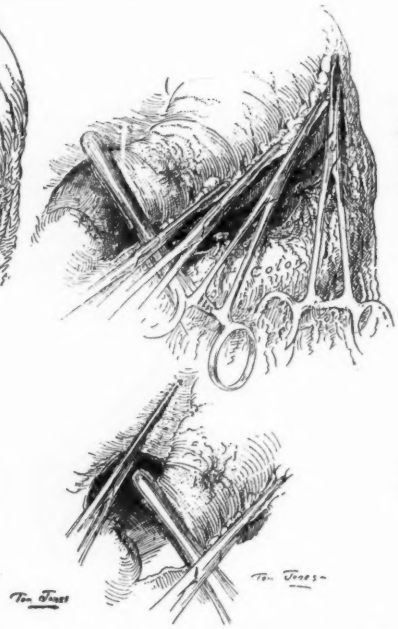

Fig. 10. The stomach has been mobilized and clamped. A pursestring has been used on the duodenum, the stump has been inverted. (Ochsner.)

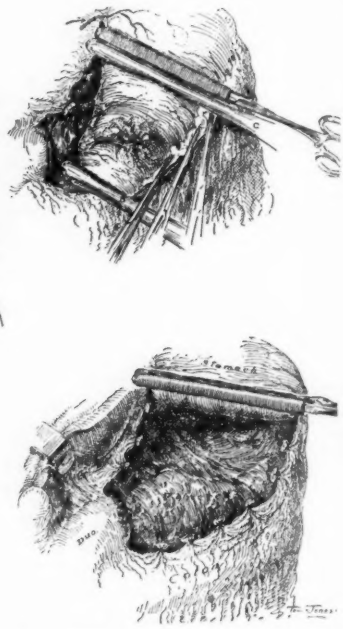

Fig. 11. The ulcer-bearing area has been removed. (Ochsner.)

This method has given us some of our best results. The patients have rapidly increased in weight. One patient must be mentioned particularly as he gained 25 pounds in weight and returned to the hospital as an orderly.

A gastro-enterostomy has never been performed after an operation for an ulcer on the posterior wall of the stomach. It is not necessary because the lumen of the stomach is not encroached upon to any appreciable extent. After the ulcer is removed the stomach is sewed in the plane opposite to the incision in the stomach.

ULCERS ON THE POSTERIOR WALL OF THE DUODENUM

Ulcers on the posterior wall of the duodenum are not so easy to handle technically as those on the anterior surface. Ulcers on the anterior wall

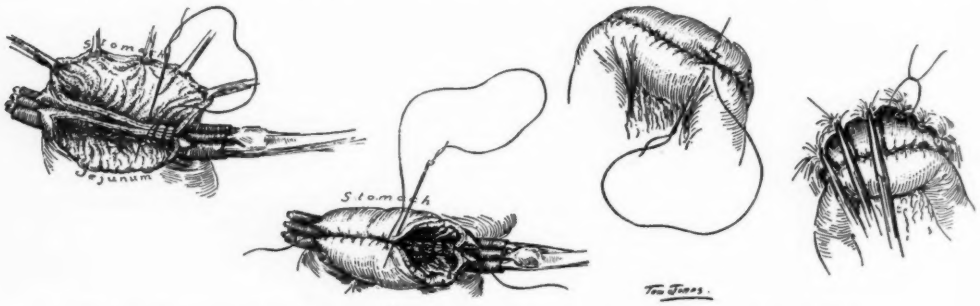

Fig. 12. By means of a three-bladed clamp a posterior gastro-enterostomy is performed. (Ochsner.)

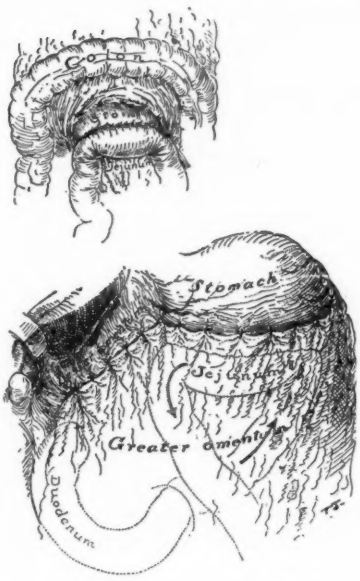

Fig. 13. The completed operation. (Ochsner.)

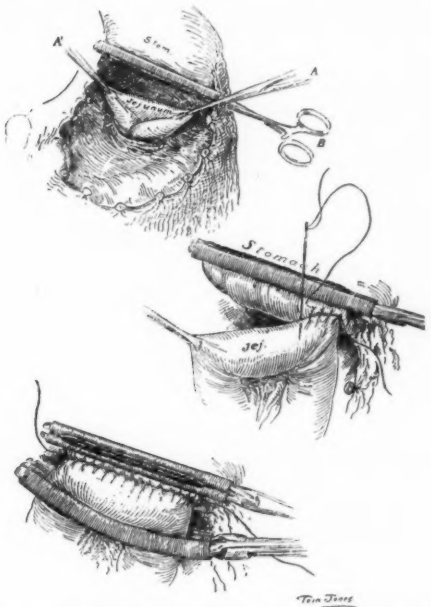

Fig. 14. Bringing the jejunum to the cut end of the stomach as in the Pòlya operation. (Ochsner.)

can be excised readily and the cut edges brought together. On the posterior wall, however, on account of more or less fixation to the underlying structures by means of the peritoneum, together with the added inflammation, an excision of the entire ulcer-bearing area, is, to my mind, the procedure of preference. I have used the technique described in an article by Ochsner in the *Surgical Clinics of Chicago*, October, 1919. While the illustrations show the ulcer nearer the pylorus than the duodenum, the various steps of the operation are performed in a similar manner. In the first illustration the duodenum is mobilized, then clamped above and below the ulcer-bearing area. The diseased portion is then excised by means of the cautery, the distal and proximal ends are closed, a purse-string suture is placed about an inch from either end, and then the sutured ends are inverted, the purse string is pulled taut, and a few running sutures close the remaining aperture. In some cases when the ulcer encroaches on the stomach itself, it may be necessary to mobilize the stomach to a considerable extent, and, instead of performing a posterior gastro-enterostomy, the jejunum may be brought up through an incision in the transverse mesocolon or over the transverse colon and attached to the cut end of the stomach anteriorly. This is commonly known as the Pólya operation (Figs. 9 to 14).

Another method of treating the open ends is to perform an end-to-end anastomosis of duodenum and stomach, but I believe the best results will be secured if one of the foregoing procedures is followed. After operation on the duodenum, a posterior gastro-enterostomy is always performed, unless end-to-end anastomosis is done, or possibly some other technique such as the Finney or Horsley operation.

CONCLUSIONS

Greater accuracy should be sought in the diagnosis of ulcers on the posterior wall of the stomach and duodenum.

The surgeon must be prepared to treat ulcers on the posterior wall of the stomach by any one of the various routes outlined. A gastro-enterostomy is not necessary following these operations.

Ulcers on the posterior wall of the duodenum are best treated by an excision of the duodenum and pylorus followed by a gastro-enterostomy, a pyloroplasty or a gastroduodenostomy.

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JUNE 1922

THE PANCREAS IN SURGERY

HOW many surgeons who operate on the abdomen are always careful to feel of and, if possible, to look at the pancreas, especially when they are operating for gall stones or duodenal ulcer, or the like? The pancreas is the most deeply seated, and if not the most important, at least the most complicated in functions and relations of all the abdominal organs. It is loose in structure, irregular in development, lies in a deep and protected position, and varies in size and relations. The casual variations in the development of its ducts are many, so that plugging of the duct of Wirsung by a stone in the ampulla may block it up entirely or the duct of Santorini may take up the work and no harm result to the pancreas except for the entrance of bile, which however, may do harm enough by causing an acute pancreatitis. The head of the pancreas in a certain proportion of cases surrounds the common bile duct, so that a moderate swelling of the organ causes jaundice, which will not result if the duct, as in normal cases, runs along the border of the head.

Who that does not familiarize himself with the feel of the normal pancreas knows anything about the tumors caused by a localized chronic swelling in the head; about pancreatic cysts, which may be quite extensive in the interior of the organ, without much outside projection; about early cancer of the pancreas? Doctors Deaver and Sweet seem to me to have made out a good case for the causation of what the surgeon calls chronic pancreatitis (which is nothing more or less than an inflammatory swelling of the organ, usually limited to the head, and lasting a varying time according to the persistence of the cause) by extension from the gall bladder or other infections, and for the treatment by removal of the gall bladder, or more rarely of other sources of infection. But if, through inadvertence or carelessness, the gall bladder be removed in a case of cancer of the pancreas, when sooner or later we are going to need it for cholecystogastrostomy for the relief of jaundice, more harm than good has been done. Cysts of the pancreas are not benefited by such treatment, nor is the swollen head of the pancreas which accompanies sometimes a stone in the common duct.

In general, in jaundice cases, when the surgeon is uncertain whether the swollen head of the pancreas is blocking the duct or whether an infection is the cause, the gall bladder would better be drained than removed, unless it is too thickened and contracted, when the duct must be drained. Long-continued, intractable, chronic pancreatitis, or swelling of the pancreas requires cholecystogastrostomy for its relief, just as much as cancer of the pancreas, and here also there is a prospect of cure. So we must be very careful, if the gall

bladder be in a suitable condition for use in drainage in these cases, not to remove it, but drain it, as Archibald has suggested; whereas, in the early non-jaundice cases, removal of the gall bladder is the best treatment of which we know.

With the real chronic pancreatitis, known to the pathologist, and its two varieties, interlobular and interacinar, the surgeon has little to do. It is noteworthy that in the interlobular variety the pancreas is hardened, nodular, and contracted instead of enlarged. The process is one of scirrhosis of the ramifying fibrous framework, a scirrhosis resembling in many ways scirrhosis of the liver. In the interacinar variety the scirrhosis involves the finer ramifications of fibrous tissue, between the ultimate glandular elements, and here again the organ itself is not enlarged. This variety by involving the islands of Langerhans is a very common cause of diabetes, but again it does not concern the surgeon.

Acute pancreatitis and pancreatic abscess, fat necrosis, peripancreatic hæmorrhage—how much are these relieved by gall bladder drainage? Sometimes this is successful, but rarely is the arrangement of the ducts such as to render gall bladder drainage efficient in draining the bile or other infected material from the pancreas. Here in addition to bile drainage, we should never neglect scoring the peritoneum over the organ, incision of abscesses, and free drainage. The fact that gall stones frequently accompany and may even cause acute pancreatitis makes it by no means certain that their removal will cure it. It is aggravating to learn of the removal of gall stones in a patient with swollen pancreas, when the surgeon says that the pancreas varies so in size that it may be within normal limits, and then learn that the patient died in a day or two of acute pancreatitis without any attempt being made at direct drainage.

The surgeon who does not familiarize himself with the normal pancreas and then with its various pathological manifestations, does not look for fat necrosis and soft spots, and high tension in acute cases, and for the underlying cause in chronic cases, is neglecting his patients, and will occasionally lose a valuable life. This field into which so many rush, with the carelessness bred of ignorance, is one in which experience, study, and care are of the greatest importance and where carelessness, ignorance, and bad judgment meet their destined but pitiful reward.

FRED B. LUND

PERFORATIONS AND THE "FATAL IMPROVEMENT"

MANY truths accepted in theory are difficult to put into practice. Circumstances which concern the practical aspects of the life and social conditions of the patient, over which the doctor has no control, influence thought and action, so that what the science of medicine might accomplish for the patient in a given case may be limited.

We accept the theorem that early operation for perforation of a viscus is necessary to save life. On the platform before medical societies we assume that the question is not debatable, but at the bedside we waver. Uncertainty of diagnosis, the timidity of the patient, and the prejudices of the family, may render presentation of the desirability of early operation unconvincing. Owing to overstrong emphasis on the necessity for early operation, the patient may be placed in the hands of an irregular practitioner or a Christian scientist is called; the patient recovers, (there are perhaps three chances in four that recovery will take place as a natural process), and the restoration is attributed to the services of the

cult exponent. In approximately 75 per cent of cases of acute, subacute, and protected perforations the patient eventually recovers, but 25 per cent is a terrific death rate. The morbidity in these cases and the probable necessity for later operations to effect cure are also grave considerations.

Prognosis is a fine art. Human judgment is fallible and the physician's dilemma too often depends on a frail clinical decision. The most frequent and misleading cause of failure to insist on immediate operation is what might be termed the "fatal improvement" which develops with the patient's reaction from the shock of the perforation. When acute perforation occurs, a group of symptoms develop which are readily recognized; they are pain, vomiting, muscular rigidity with the knees and thorax flexed, anxious expression, and increasing pulse and temperature, resulting in a condition of shock, during which intestinal peristalsis is stopped. In a few hours, reaction from this condition takes place, and under the influence of the anodyne usually given, the patient becomes fairly comfortable. The abdominal rigidity, however, in the cases of serious perforation remains constant. The escape of septic material into the peritoneal cavity causes a temporarily localized contamination of a limited field. In the asthenic condition which immediately follows the catastrophe, the contamination, except as it is carried by the escaping material, remains in the vicinity of the perforation. With the reaction, intestinal movements again begin, the septic material is spread, and the safe time for operation has passed. The reactionary improvement too often leads the attending physician to an unwarrantably favorable prognosis and delay which results in a fatal termination.

Perforations of the appendix are the most common. In the majority of persons the mechanical conditions around the appendix are favorable for localization. Even when the appendix is located in the pelvis the resultant infection may be limited by the epiploic tags of the sigmoid and omentum, and a septic accumulation involving the entire small intestinal area below the transverse colon may effectually be localized. The pelvic peritoneum through age-long exposure to infection has acquired a remarkable power of resistance which is not shared by the peritoneum of the upper part of the abdominal cavity. To reach the general circulation from the lower half of the abdomen the infective material must pass through the portal circulation of the liver, the great organ of protection. From the upper half of the abdomen the infected material passes into the mediastinal spaces and reaches the general circulation direct, resulting in the complicating bronchopneumonia which so often is the immediate cause of death in cases of septic peritonitis. This is particularly true of the central tendon of the diaphragm through which solid particles may pass. Perforation of the duodenum often causes a limited contamination, as the amount of septic material that escapes may be small and relatively sterile. The escaping material often gravitates into the right iliac fossa. In many such cases the appendix is removed, libelled by the statement that the infection has passed through normal mucous membrane. However, the patient often recovers in spite of an unneccessary appendectomy and in the presence of duodenal perforation.

Perforations of the stomach are less favorable from the standpoint of prognosis than those of the duodenum; the quantity of escaping material may be large and contain septic particles of food, which by gravitation to the unprotected diaphragm, results in early general sepsis. The surroundings of the stomach are such that attempts at encap-

sulation of the escaping contents are liable to be ineffectual or may lead to the development of a subdiaphragmatic abscess.

Perforation of the gall bladder into the free peritoneal cavity is often fatal, not from inherent causes, for bacteria which have passed through the liver to reach the gall bladder are greatly reduced in virulence, but because, as a rule, the gall-stone attacks so closely resemble the attack that ends in perforation that they are attributed to gall-stone colic and the patient is allowed to drift for some days before the real difficulty is recognized.

Simultaneous perforations of the gall bladder and appendix are rather common. The rule is that the patient has gall stones. An acute infection of the appendix permits the passage of bacteria into the portal circulation and the gall-stone-infested gall bladder rapidly becomes involved. In a large percentage of such cases the infecting organisms belong to the colon group, and cause a foul fæcal odor; in these cases the appendix should always be examined for coincident perforation.

Frankness in dealing with the patient, the family, and the friends, is the wise policy. When those interested understand the slight risk of operation in the early stage, and that the responsibility for delay must be borne by them and not by the physician, they, as a rule, become amenable to reason.

WILLIAM J. MAYO.

THE TREATMENT OF CHRONIC MALIGN DISEASES OF LYMPH GLANDS

CHRONIC malign diseases of lymph glands are protracted contests between bacterial or neoplastic parasitic cells, acting upon the offense either separately or in combination, and the tissues of the host reacting upon the defense. The unaided powers of defense are never adequate to produce spontaneous recovery. However gradually one of these diseases may begin and progress and however effectively the defensive reactions may intermittently check its advances or even induce temporary regressions, if the process is malign for the individual affected the end-result is the same. Eventually a progressing incapacity of sources of reserve powers of resistance, which are resident in the hæmatopoietic structures, is caused by prolonged toxæmia. Henceforth increasing disability and death are inevitable.

Three types of diseases are in this category: granulomata (tuberculosis), neoplasmata (carcinoma), and the group intermediate between granulomata and neoplasmata (Hodgkin's disease, leukæmia, lymphosarcoma, etc.). All three have much in common. They become established only in susceptible individuals, i.e. those having some biological deficiency. Their modes of offense and the defensive responses provoked are similar or identical. Their ultimate effect upon untreated patients is the same. Their two great points of difference, etiology and histopathology, are of little consequence to the afflicted who are in need of permanent symptomatic relief.

The present general dissatisfaction with the results of treatment is largely attributable to misconceptions of the pathogeneses involved. Too much attention has been focused upon the morbid process and too little upon the patient's defense. A combination of the two, offense and defense, constitutes disease, the control of which is the real problem to be solved.

Seeking for "cures" of malign diseases is scarcely more rational than Ponce de Leon's search for the fountain of youth. A cure means an elimination of a malady so complete as to preclude all possibility of a recrudescence. Facts now established prove that

cures of tuberculosis are in reality but symptomatic recoveries because living tubercle bacilli persist and are demonstrable postmortem no matter how perfect or how prolonged a recovery may have been. Likewise it is known that recrudescences may occur after long intervals of latency during which there has been faulty presumptions of cure. It is becoming more evident that similar conditions obtain in cancer and in diseases of the Hodgkin's type and that actual cures of these maladies are not only rare but no more satisfactory than symptomatic recoveries. Latent periods of 30 and of 11 years have been noted in cancer and Hodgkin's disease respectively and many cures have been erroneously proclaimed after shorter intervals of symptomatic relief. Pursuits of mythical panaceas have obscured possible attainments with methods at hand. Malign diseases can be converted into benign diseases at least temporarily. The duration of the periods of benignancy is determined by both the degree of malignancy, or the relative preponderance of powers of disease offense over individual defense at the time treatment is begun and by the thoroughness of the treatment.

If treatment is to provide every opportunity for lasting recovery, three accomplishments are prerequisite: first step, an elimination of the portal of entry or of the initial lesion; second step, a material subtraction from the bulk of the disease (lymphoma), and, finally, the third step, an increase in defensive powers of individual to highest possible level, which level should be permanently maintained.

The methods in vogue to accomplish the first step are extirpation, cauterization, and radiation. Each has its advantages under certain conditions. In general, clean excisions are the more certain to be effective, to permit of the smoothest healing and to interfere least with the third step.

The methods being used in the second step to combat the lymphomata are excision, radiation, and various forms of heliotherapy. Excision is the method of choice if more than transient palliation is still possible.

Halsted has established the achievements as well as the limitations of surgery. Steps one and two can be accomplished in so far as securing permanent freedom from disease in the areas subjected to operation and no farther. These local or regional cures are assured only when the extirpations are complete, which means a removal of all lymph glands, gland-bearing and disease-bearing tissues within and just beyond the frontiers of the affected area. Thus has been proved the true conservatism in combatting malign affections, namely the utmost operative radicalism. There need be and should be no handicap to increase of resistance after these operations. On the contrary local and general resistance will be augmented by proper and prompt excisions. Such operations suffice to initiate improvement that can amount to recovery if step three be not neglected.

Radiation either by X-ray or radium is invaluable in treating certain initial lesions that cannot satisfactorily be excised or cauterized, and in reducing the size of lymphomata that cannot be extirpated. Defects in present radiotherapeutic methods have restricted the indications for its use at least temporarily. Emanations may fail to control and can even stimulate the activity in initial lesions. Disease processes within malign lymphomata can be modified but not destroyed by radiation, and sooner or later cannot even be controlled. Radiotherapeutic doses now generally held to be effective are injurious to the hæmatopoietic system. Consequently, if the lymphomata are benefited, general resistance is reduced and progress of the morbid process is ultimately fostered.

The question of postoperative radiation of areas excised can be answered. If the extirpation has been complete, radiation can only do harm; if it has been incomplete, transient benefits are conceivable.

Heliotherapy is of great value in after treatment because of beneficial effects upon both local and general resistance. Increased activity of erythroblasts and lymphoblasts is obtainable and invaluable, as is also local hyperæmia. The balance of after-treatment which must be persistent because the biological defect that makes the disease possible is as a rule inherent, if not inherited, includes all details that make for unusually healthful living. Methods employed in the treatment of tuberculosis suffice.

Better results follow as methods improve. The greatest obstacle to progress is therapeutic pacificism, usually called conservatism, by the blood-shy and those unwilling to see and to face facts. Earlier diagnoses are required, not so much of the exact nature of the affection but as to whether it is malign or benign. The more promptly a malign process is recognized, the less the degree of malignancy of that disease in the patient; and the sooner the most radical treatment warranted by conditions is instituted, the better the prospects for recovery. Few fatalities will result if benign diseases be treated as if they were malign. On the contrary procrastination in radical treatment of malign diseases condemns the great majority of patients to greater distress and danger if not to death.

The principles involved in exact methods of treatment need only to be understood to be accepted and applied. So long as a person is anatomically normal, physiological abnormality and disease is impossible. Morbid anatomical states assure morbid physiological processes. A restitution of normal or approximately normal anatomical conditions is the keystone of recovery and produces recovery in benign diseases. Successful treatment of malign diseases requires additional measures. The basic cause of these maladies is an unknown somatic weakness, and the secondary factor is the presence of parasitic cells which cannot as a rule be entirely removed or destroyed. Consequently there must be anatomical readjustment not to, but beyond normal—a compensatory lymphoblastic hyperplasia induced by extirpation, so there may be an overcorrection opposed to the inherent weakness. Surgical reconstruction is required to start recovery. Continued after-care to enhance and to protect general health is almost equally necessary to make that recovery permanent. J. L. YATES.

AMERICAN COLLEGE OF SURGEONS

SOUTH AMERICAN SURGEONS

REPORT OF OFFICIAL VISIT TO BRAZIL, URUGUAY, ARGENTINA, CHILE, PERU, AND PANAMA BY FRANCIS P. CORRIGAN, A.B., M.D., F.A.C.S., CLEVELAND, OHIO

IT is my privilege to report to the Fellows of the American College of Surgeons the present status of our Pan-American development. The movement to embrace the South American countries in this great guild, which is organized to elevate the standard of surgery, was inaugurated in 1920 by Dr. William J. Mayo and Dr. Franklin H. Martin. Dr. Martin, accompanied by Dr. Thomas J. Watkins and the writer, returned to the field in 1921. The present article is the third chapter of the story of this scientific inter-relationship.

The movement described as Pan-American had its birth in Faneuil Hall. The American Declaration of Independence and the succeeding world-stirring political events had its result in the present group of North and South American nations. They have in common the political ideal that governments derive their just powers from the consent of the governed. The first Pan-American manifestation was political. The leaders of the movement that brought about the independence of the South American countries, men like Simon Bolivar, San Martin, and O'Higgins, were practically all men who had been here personally or had at least imbibed the ideas of Washington, Jefferson, Franklin, and the other great founders of the United States. There was at that time and for many years thereafter a strong current of sympathy between those countries and the United States.

The second phase of the movement was commercial interchange. Commerce, although the life-blood of nations, sometimes carries in its current annoying parasites. The commercial relationship, in the main healthy, has too often been marred by individual selfishness.

The present phase of the Pan-American movement is cultural. It is characterized by interchange of ideas in art, literature, and science. It is interested in the beautiful and the true. It seeks by closer acquaintanceship to develop real friendship and to share useful information. For North Americans to understand South Americans, and vice versa, and thus approach real friendship, it is necessary that each divest himself in a measure of his own very different environment.

"In the United States the houses all have chimneys," was the unexpected answer I received from a resident of the tropics when I asked him what feature in the United States had most impressed him on his first visit. To the majority of Americans nothing could be more ordinary than chimneys on houses. To him it was a peculiar feature of the landscape.

I narrate this little incident to show how dissimilar environments may be and how essential it is for each to respect the other's point of view. If, therefore, one goes into these countries in a spirit of intellectual snobbishness, with the idea that one can learn nothing, it is certain that one will not be disappointed. It is equally certain that the intelligent, open-minded man will find much to admire and to imitate. For instance, the method of handling problems incident to tropical climates might be utilized with benefit in some of our hot Southern states.

The scientific bodies of North and South America have been rather diffident in their approach. Science is not as brash or as self-confident as commerce, because true science realizes its limitations and is duly humble. It may be for this reason that it has been well received.

Some idea of the influences now operating toward a genuine scientific reciprocity between North and South America might be gained by scanning the list of my fellow passengers on the SS. Aeolus which sailed from New York on February 2, 1922.

Dr. Richard Pearce of the General Educational Board, and Dr. Frederick F. Russell, director of laboratories, for the Rockefeller Foundation, were on their way to Brazil to "pass around any useful information that they might have." At least such is the description of the great work of the Foundation as expressed by its modest founder.

Specifically, these gentlemen were on their way to render such aid as the Brazilian government might desire in furthering the program of sanitation and medical education which it has under way.

Dr. Mark Boyd, an expert in malaria control, accompanied by Mr. Estus Magoon, a sanitary engineer, have been engaged by the Brazilian government to make a survey of the situation with regard to the elimination of malaria which is so prevalent in all tropical countries. Miss Clara L. Kieninger and Miss Louise M. Pitz, American nurses, formerly of the American Army in France, were going forth to another assignment on foreign land. These young ladies, selected by the International Health Board for the Brazilian government, are charged with the heavy responsibility of inaugurating a nurses' training school in a government hospital in Brazil. This is the first attempt to establish such a school according to American ideas, and much depends upon its success. Dr. Paulo de Proenca, a young Brazilian doctor, was returning, after spending two years in the laboratories of American universities, to take up his work in the Oswaldo Cruz Institute, the great research laboratory of Rio de Janeiro.

As representing interests other than medicine, I might mention Professor Edwin W. Kemmerer, of Princeton University, who was on his way to confer with representatives of various South American governments about currency and banking problems. Colonel C. C. Collier and his staff. Colonel Collier is commissioner general for the United States government to the exposition which is to be opened in September of this year in celebration of the Centennial of Brazilian Independence. The United States government has appropriated one million dollars toward this celebration, a part of which will be expended in the erection of an exposition building. This building is to be a permanent structure and after the exposition it will house the American Embassy. Our extensive participation in this celebration is not more than the repayment of a courtesy as Dom Pedro, then emperor of Brazil, was the only actual head of a government who personally visited our Centennial in Philadelphia in 1876.

Such are the influences which are bringing about between the two Americas a new era of understanding and friendship.

Rio de Janeiro, Brazil

At Rio de Janeiro, after a pleasant two-weeks' voyage, we were met by a committee of medical men who boarded our ship to greet us. This committee was made up of men interested in sanitary problems, medical men who came to meet the representatives of the Rockefeller Foundation, and surgeons (headed by my friend, Dr. José de Mendonça) who came to meet me as the representative of the surgeons of North America. Others of the committee were Dr. Carlos Chagas of the Oswaldo Cruz Institute, Dr. Oscar Clark, Dr. Hackett, and Dr. Bowman C. Crowell of the International Health Board.

The usual asperities and inconveniences of passing through the Custom House having been considerably ameliorated by our kind hosts, I was escorted to the very comfortable Palace Hotel by Dr. José de Mendonça, Dr. Oscar Clark, and Dr. Jayme Poggi. I will not attempt to describe the arrangements that were made for my entertainment, the pleasant hours spent, nor the delightful excursions which I made, accompanied by my kind hosts, to the many beautiful places around the bay, the wonderful botanical gardens, and other things with which my time was filled preliminary to our conference. I will say a word only of the new St. Francis de Assisi Hospital which is being rebuilt by the Brazilian government, and in which a modern nurses' training school, based on the principles of training schools in this country, is to be installed. This reorganization represents to my mind the beginning of a new era in the history of Brazilian hospitals.

I cannot forbear a few remarks about Corcovado, and the wonderful view which may be had from the top of that mountain. I can best describe it as an ideal place for a honeymooner and his bride where they may hold hands until the sun has set beyond "The Fingers of God," a mountain across the Bay of Rio de Janeiro, and watch the lights come on in the Cidade de São Sebastiao (City of St. Sebastian) as it is affectionately known to its citizens. This beautiful bay was named the "River of January" by the Portuguese sailors who first discovered it in the month of January. They erred in their belief that they were at the mouth of a great river. The city of Rio de Janeiro is strewn helter-skelter in the valleys between the mountains. The charm of Naples and Madeira is here magnified a hundred times. Besides being beautiful, the city is clean. On all sides it is bathed by ocean bayous. The many mountains among which the city lies are covered with virgin forests. The water wends its way from the mountains and is pure and soft. Since the elimination of yellow fever by Dr. Oswaldo Cruz, health conditions have been excellent. Infant mortality is still high but outside of this, the general mortality is comparatively low.

The formal conference of the Rio de Janeiro committee on credentials of the American College of Surgeons was called for 2 p. m., February 18, the day following my arrival. Dr. de Mendonça presided and Dr. Olympia da Fonseca acted as secretary. After I had completed the pleasant duty of extending the salutations and greetings of the Fellows of the College whom I represented, three points were brought up for consideration:

1. *The future of the College in Brazil.*
   a. Its numerical extension;
   b. Method for extending Fellowship to men in all sections of Brazil who meet the requirements of the College.

I told of our appreciation of the forces of Brazil and of our desire for a strong organization in that country. It was agreed that a movement should be started to secure the applications of as many as possible of the representative surgeons of Brazil. The committee in Rio de Janeiro agreed to enter into correspondence with eligible men and with the other committees already established in Brazil, urging them to take steps looking toward a healthy expansion of activities.

2. *The Cruise of the Fellows of the American College.* The proposed expedition to South America in February, 1923.

All who were present expressed their gratification and extended to the American College of Surgeons a hearty invitation. I informed them that their colleagues, the leading surgeons of the United States and Canada, would take advantage of the opportunity to participate in the Centennial of the Independence of Brazil, and that they would visit the Exposition, which will be a feature of that Centennial and in which our government expects to take prominent part.

3. *Prospects for hospital development and progress in Brazil.*

We discussed the hospital standardization program of the College. How was it being received and what steps, if any, were being taken to bring about its adoption? Their response was most encouraging. The Public Health Department of the Brazilian government is just completing the new hospital of St. Francis de Assisi. This hospital, as I mentioned above, will have a modern training school organized by competent American nurses. I have since had an opportunity to inspect the hospital which will be opened within a few weeks. While it is an old building which has been remodelled, on the whole it is very good. Dr. de Mendonça has prepared a complete program for the erection of four new hospitals of one thousand beds each which are to be located in four separate sections of the city. The plans for these hospitals conform very closely to our standard. This program has been incorporated in a bill which is now before Congress with every prospect of being speedily enacted.

In addition to the foregoing the Penitencia Hospital, which consists of a few old buildings which house about forty beds, is to be replaced by a two hundred and fifty bed hospital. The plans, which I have seen, are being prepared under the direction of Dr. Fernando Vaz, a Fellow of the American College of Surgeons, and, as he himself says, "half American." The Penitencia has an ideal location, and the monks who own it have in hand the necessary funds and the building will be under way in about two months. The institution will be a splendid one and Dr. Vaz contemplates organization along the most modern lines. If these plans materialize (and it appears that they will) the hospital situation in Rio de Janeiro will be revolutionized within the next five years. Dr. Vaz and his associates also have under construction a magnificent medical and surgical clinic in which they propose to institute group practice for their private work.

The surgical services in Brazil, as in all of South America, are organized by wards instead of by hospitals. Surgery on the Southern continent has been largely influenced by Parisian methods. It is the French system of individual artistry, as compared with the American system of team-work or group practice. The French method develops individual surgeons rather than a system of surgery.

On Wednesday, February 22, Dr. Russell, Dr. Pearce, and I were tendered a farewell *almoco* (breakfast) at the Jockey Club. Professor Miguel Couto presided and Dr. Chagas was toastmaster. Among the honored guests was Mr. Edward Morgan, the American Ambassador. About forty of the leading medical men of Rio de Janeiro attended. As indicating the spirit in which we were received, I quote verbatim from the address by Dr. José de Mendonça:

> Gentlemen: We have the honor to receive also as our guest Dr. Francis P. Corrigan, representative of the American College of Surgeons, a more recently organized institution than the Rockefeller Foundation, but no less useful to the health of humanity and to the progress of medical science. If the Foundation, wealthy and admirably directed, establishes medical missions, laboratories, hospitals, and medical colleges, and aids all useful things that have been accomplished in this line all over the world, the College visits, examines and advises, and, acting under its great scientific and moral authority, it encourages all institutions with which it comes into contact to develop their efficiency, and it awakens in them a useful competition which most assuredly will result in immense progress in medical science. The Foundation creates and organizes; the College educates, develops and moralizes.

Dr. Corrigan, this luncheon which is offered also to you as representative of the American College of Surgeons, signifies a hearty hand-shake from the Brazilian surgeons to their brothers of North America, to the prosperity of the American College of Surgeons, and to the good fortune of the Rockefeller Foundation.

With such messages ringing in our ears, Dr. Russell, Dr. Pearce and I departed from Rio de Janeiro on the night train for São Paulo.

São Paulo, Brazil

Arriving in São Paulo on February 23, we were met in the poetically named Estacão da Luz (Station of Light) by a large gathering of medical men, including Dr. J. Alves de Lima, chairman of our committee on credentials, and Dr. Benedicto Montenegro, secretary; also Lieutenant Tenorio de Brito, representing the president of the state, and Dr. José Lannes, representing the secretary of the interior.

São Paulo is situated at an altitude of nearly 3,000 feet, and the weather seems delightfully cool. Our visit was taken very seriously indeed. Representatives of both the Rockefeller Foundation and of the American College of Surgeons having arrived on the same train, good material was provided for the newspapers. I had notified the São Paulo surgeons by telegraph that I would arrive in their city on the morning of February 23, and they arranged a conference for the evening of that day.

We were escorted to our hotel by the committee, and in accordance with the hospitable custom which is in vogue everywhere in São Paulo, the greatest coffee state in the world, we all had coffee. At 3:30 in the afternoon we had an audience with the president of the state of São Paulo, Dr. Washington Pereira de Souza, a tall, handsome, distinguished looking man with gray moustache and imperial; also with the secretary of the interior, Senhor Alarico Silveira. States' rights obtain strongly in Brazil, and the important state of São Paulo has an almost independent government comprised of a president and a complete cabinet. The president of São Paulo is always a logical candidate for the president of the nation.

Before going to the meeting in the evening, I enjoyed a family dinner at the home of Dr. de Lima, whom I had met in Philadelphia. This dinner with Dr. de Lima and his family gave me a pleasant insight into home life in Brazil. The doctor has a charming wife, and six beautiful children all of whom converse fluently in English.

Dr. de Lima has a wonderful collection of plates, one from the great Napoleon's table, and other examples of the first products of Sevres and Delft. They are artistically distributed around the walls of the high-ceilinged dining room. On the walls of the living room, where we adjourned for our after dinner liqueur, was a collection of steel armor and weapons which belonged to the knightly ancestors of the family.

After dinner we went to the headquarters of the Society of Medicine and Surgery of São Paulo to meet with the committee. Dr. de Lima presided, and the following were present: Dr. Montenegro, Dr. Candido de Camargo, Dr. Rezende Puech, and Dr. Moraes Barrows. Dr. Meira Filho and Dr. Lindenberg were absent from the city, and Dr. Baetas Neves was confined to his bed. In general, the same things were considered as at the Rio de Janeiro meeting. The suggestion of expansion of activities brought up the question of division of jurisdiction between the São Paulo and Rio de Janeiro committees. Dr. de Lima suggested that São Paulo control the states of São Paulo, Santa Catharina, Rio Grande do Sul, Parana, Goyaz, Matto Grosso, and Minas Geraes, seven in all, leaving Rio de Janeiro in control of all of the northern states, fourteen in number.

Dr. Benedicto Montenegro, our very active and intelligent secretary, a graduate of the University of Pennsylvania, School of Medicine, was instructed to undertake the correspondence necessary to get into touch with the eligible men in other parts of the state of São Paulo. I was gratified at their genuine interest and enthusiasm for the work of the College, and the conscientious way in which they approached the problems. When told about the proposed cruise, the surgeons of São Paulo were very enthusiastic in extending an invitation to their North American confrères. I am sure many of the Fellows will take the interesting ride from Rio de Janeiro to São Paulo and then down over the wonderful silver-plated road to Santos. The trip will repay them for their efforts, and they will indeed be very welcome in São Paulo. There is considerable friendly rivalry between Rio de Janeiro and São Paulo, which results in a healthy competition. They will strive to outdo each other in their hospitality.

On the second day of my stay in São Paulo, after a trip to some of the hospitals of the city and to the famous snake farm, I was entertained by the Fellows of the College at an *almoco* in the Automobile Club. São Paulo's rapid growth has not been accompanied by a corresponding development of hospital facilities. The principal municipal hospital is lamentably overcrowded. In most of the wards, there are as many patients lying on mattresses spread on the floors as there are in beds. There is as yet no adequate plan for remedying this condition as there is in Rio de

Janeiro. The medical profession, however, is not to blame. It is simply another example of the weakness of the system of control by politicians over activities that should be supervised by technical experts.

Both Rio de Janeiro and São Paulo, the two leading cities of Brazil, have enjoyed a wonderful growth. São Paulo, which in 1890 had a population of only slightly more than 60,000, is now a city of nearly 700,000, while the population of Rio de Janeiro is now about 1,125,000. Industrial progress is also great. Before the war, Brazil depended entirely on Europe and the United States for manufactured articles. Bad conditions beget their own remedies. You can now buy clothes, shoes, sterilizers, bath tubs, plumbing goods and so on of native manufacture much cheaper than the imported article. Agricultural development is also proceeding rapidly. As a proof of alertness along this line, I heard that poison gas was now being used by the south Brazilian farmers to destroy termites and other insect-enemies. It would be strange if this terrible destructive agent might yet prove to be a great boon to mankind. Brazil is already a great manufacturing and exporting nation, and Rio de Janeiro is destined to become the New York of South America. The spirit of friendliness in Brazil for all things American was very marked.

Montevideo, Uruguay, and Buenos Aires, Argentina

I left São Paulo at 8:40 a. m. on February 26 and, after a most interesting ride over the wonderful railroad to Santos, which has been so well described by Dr. Martin, I embarked on board the Italian steamer "Principessa Mafalda," bound for Montevideo and Buenos Aires. During the few hours that our ship remained in Montevideo, I got into touch with Dr. Enrique Pouey, the chairman of the credentials committee for Uruguay. Without realizing the difficulties into which I was getting myself, I arranged with him for a meeting on Wednesday at 10 a.m., it being now Monday night.

Proceeding on the "Principessa Mafalda," I arrived in the busy harbor of Buenos Aires at about one o'clock the following afternoon, Tuesday, February 28. I went immediately to the Plaza Hotel, and after finding that the river boat for Montevideo was due to leave at 10 p. m., I proceeded to the telephone as I would at home, and got into touch shortly with Dr. Rodolfo Pasman, the secretary of our committee.

While waiting for Dr. Pasman, I thought to improve the time by looking up my passage back to Uruguay. I descended to the lobby and asked the hotel porter to secure my ticket and reservation back to Montevideo. "But have you a *cédula de identificacion* (identification seal)?" I learned that this was a necessary document without which I could not purchase a ticket to Montevideo and return. The Police Department was called—it was a holiday—Mardi Gras in fact. I was advised to go to the Police Department myself. I did so but came back empty handed with instructions to return at 4:30 p. m. Meanwhile, Dr. Pasman came along. After we had a talk about American College affairs, he accompanied me to the Police investigation bureau. Finally, after several trips, at seven o'clock in the evening, we got the necessary provisional certificate.

I learned from Dr. Pasman, and Dr. Robert Halahan whom I had known since the Montreal meeting, that it was vacation time and most of the men that I wanted to meet were still out of town. We arranged a conference for my return. So after nine busy hours in Buenos Aires, I started back across the Rio de la Plata on a speedy river ship called the "Cabo Corrientos."

I was received in Montevideo by Dr. Enrique Pouey who came to greet me and to welcome me to Uruguay. He announced that our meeting was arranged for 10 a. m.

At this meeting, which was held on March 1 in the Salon of the Hotel Lanata, practically every member of the credentials committee was present. I was given a rousing reception and literally greeted with open arms by a lot of splendid fellows. Those who were present at the meeting were Dr. Enrique Pouey, Dr. Alfredo Navarro, Dr. Manuel Albo, Dr. Julio Nin y Silva, Dr. Juan Pou Orfila. Dr. Pouey presided. We discussed in general the same subjects as were discussed at the other meetings. Afterward, I was taken for a drive around the city, through some of the beautiful boulevards and parks. One of the newer shore drives which leads out to the famous Pocitos Beach is called Avenida Woodrow Wilson. I also had an opportunity to visit the large general hospital which is the teaching hospital of the University. A striking feature of this group of hospital buildings is the new children's pavilion only recently completed. The walls are decorated with large mural paintings illustrating familiar nursery rhymes. It is a very pleasing departure from the conventional, plain hospital walls. We then returned to the hotel for an *almuerzo* with a larger group of Fellows.

At the hotel I was greeted by Dr. Garcia Lagos, who was still limping after a serious horseback

accident. This was his first time out since his accident and he pleaded his injury as his reason for not being the first to greet me, and he sent his regards to his many friends in North America.

We had a splendid meeting and all of the Fellows who did not attend sent formal regrets, giving reasons for their unavoidable absence.

Everything was pleasant in Montevideo; the doctors, the city, and most of all the warmth with which they received my news. They invited us with the utmost cordiality to visit them next year. They are all deeply interested in the College and they are a lot of fine fellows. It was with regret that I left this pleasant capital of the "Republic Oriental."

Buenos Aires. During my visit to Buenos Aires, I met with several members of the Surgical Society of that city. This is an honor society which limits its membership to recognized surgeons of good repute. In fact, I learned that the requisites for admission are very similar to those of the American College of Surgeons. Men possessing similar ideals must naturally be in harmony with the spirit of our great movement for the advancement of surgery.

In company with Dr. Pasman, I visited some of the hospitals. Many of the senior surgeons were still away on vacations. The surgical services were in charge of the younger group of men. I saw some very good work done by men of this group: Dr. Villegas, Dr. Pasman, Dr. Arano, and the younger Dr. Finochietto. They are the coming leaders of surgery in the Argentine, and form a very creditable representation for any country.

I had a most satisfactory interview with Dr. José Arce, who has recently been made rector of the University. Dr. Arce is the *Catedrático*, which means that he occupies the chair and is head of the department of surgery. I felt that he, therefore, was qualified to give the point of view of the surgical profession of Buenos Aires. He impressed me very favorably indeed. He is of fine appearance and gives one the impression of being a capable executive. In response to an inquiry from Dr. Arce, I explained to him our understanding of the Fellowship pledge of the College. I also told him that a large body of North American surgeons, leaders in their profession, were planning to come to South America next year; that they had been cordially invited by the surgeons of Brazil and of Uruguay; and I assumed that they would also receive a welcome from their colleagues in Buenos Aires, the metropolis of South America.

Dr. Arce said that he agreed with me entirely about the pledge, and assured me that he would call the surgical society together in April and that we could depend upon receiving a cordial invitation from the Argentine surgeons. The suggestion that a new pledge should be drawn up in original Spanish and not translated, as a literal translation does not always convey an identical meaning, is well taken.

After finishing my work in Buenos Aires I prepared to move on to Chile. The international train of the Trans-Andine Railroad runs only twice a week, leaving Buenos Aires on Wednesday and Sunday mornings. I still had a few difficulties to meet in Buenos Aires in the way of delay of consular visés and other technicalities incident to securing my permanent identification seal. I had only secured a provisional document for Uruguay which I had obtained under the promise that I would report back and finish the ritual for securing a permanent one before leaving the country. I will omit the details, but it is sufficient to say that they consumed much time and energy.

On Saturday morning before my departure I visited the British Hospital in company with Dr. Robert Halahan, a Fellow of the College. This is an excellent institution maintained by and for the English-speaking colony of Buenos Aires. Sir John O'Connor and Dr. Halahan are the attending surgeons. Dr. O'Connor was away at the time, but I had the pleasure of seeing Dr. Halahan do some skillful work.

During my stay in Buenos Aires, I was entertained by a group of surgeons at the famous Jockey Club, probably the most noteworthy club on this continent. Dr. Pasman also gave me a glimpse of Palermo and the race track and parks in that beautiful suburb. The police spoiled a luncheon that had been planned for me at El Tigre, the famous summer resort, as I had to spend most of the afternoon getting my *cédula de identificacion* so that I could leave on the Sunday morning train for Chile.

The Andes

At 8:30 Sunday morning I was off on the Trans-Andine Railroad, across the cattle strewn plains of Argentina. The scenery is rather monotonous after a few hours and there is little of interest until toward evening (the low grounds, immense flooded sections with billions of birds, ducks, flamingoes and others in endless variety).

I found the sleeper quite comfortable but was compelled to close the window on account of the almost suffocating dust. It was a rather trying night. Early in the morning, the train pulled into Mendoza, the wine center of Argentina. Here

we changed for the narrow-gauge road across the mountains. The Trans-Andine ride has been described by pens abler for the task. After an almost sleepless night it was something of an ordeal for me. It was extremely interesting, although I did not enjoy it as I should. I would advise anyone making the trip to break the journey at Mendoza or perhaps even higher up, rest for a day, and start afresh. It would be worth one's while. It is a wonderful journey, the descent on the Chilean side down the Aconcagua valley being especially interesting.

The train arrived at Los Andes at 7 p. m., one hour late. Los Andes is the Chilean terminus for the narrow-gauge road. The *Combinación* for Santiago and Valparaiso leaves at 8:15 p. m., so there is a rush and a hurly-burly to try and get your trunks past the customs inspectors in time to go to the near-by hotel for a bite to eat. We had had no diner on our train since lunch time, and as there is no diner on the *Combinación*, this was the only opportunity to secure food before Santiago at 11:30 p. m. By dint of effort and past football experience, I finally got my baggage through customs and had sufficient time for a hurried meal. We arrived in Santiago about midnight, and after a bath and a heaven-sent bed, I knew no more until morning.

Santiago

At Santiago, my first call was on the American Ambassador, Mr. William Miller Collier. In this connection I must express my gratitude to the State Department and the American Diplomatic and Consular representatives of the United States. They have always given splendid support and assistance.

Ambassador Collier was no exception. He arranged an appointment for two o'clock with Dr. Gregorio Amunátegui, dean of the Faculty of Medicine. He also honored me by making an appointment to present me to the president of Chile.

I met Dr. Amunátegui at his home and had a long conference with him. Dr. Amunátegui, who had been appointed chairman of the credentials committee in Santiago, arranged a meeting of the members of the American College of Surgeons for later in the week. This meeting was duly held at 4 p. m. on March 9 in Dr. Amunátegui's home. The following men were present: Dr. Gregorio Amunátegui, Dr. Luis Vargas, Dr. Eugenio Diaz Lira, Dr. Francisco Navarro, Dr. J. Valenzuela Basterrica. Dr. Amunátegui, as dean of the Faculty of Medicine, conducted the meeting, and it was characterized throughout by extreme frankness of expression. Some dissatisfaction was encountered because of the listing of a foreign mining colony with its surgeon, who was not licensed to practice medicine in Chile, at the head of the Chilean list in the year book of the College.

The opinion was expressed that a central committee with jurisdiction over the whole country of Chile would be more effective than one committee in Santiago and another in Valparaiso. Having been authorized from the headquarters of the College to make this change, the following central committee of seven members was nominated for the whole of Chile:

Dr. Gregorio Amunátegui, Santiago
Dr. Lucas Sierra, Santiago
Dr. Jerman Valenzuela Basterrica, Santiago
Dr. Luis Vargas, Santiago
Dr. Guillermo Muenich, Valparaiso
Dr. Edwyn P. Reed, Valparaiso
Dr. Alberto Adriasola, Valparaiso.

This plan and the nominations were afterward presented to the Valparaiso Fellows and agreed to by them. The reception in Valparaiso was very cordial. The meeting was held at the *Club Naval* and was attended by practically all of the Fellows residing in Valparaiso.

During my stay in Santiago, I visited three of the leading hospitals. These were all large hospitals of 700 or 800 beds with beautiful large patios filled with trees and flowers, presenting a very attractive appearance. The San Francisco de Borja, which I inspected with Dr. Luis Vargas as my guide, was especially attractive in this respect. Each of these large government hospitals has its own kitchen, bakery, laundry, etc., and is practically an independent village. In each there is a pavilion for private patients. The rates for *pensionistas*, as paying patients are called, is extremely low. Of course the greater part of the hospital is taken up by charity beds. Each has also an out-patient department. The assistants remain for a long time, as in the German hospitals, and receive a very thorough training.

I saw Dr. Coborubias, assistant to Dr. Sierra, do two difficult gall-bladder resections. The second case was as difficult a one as I have ever seen. Dr. Coborubias handled it in a masterful manner while his chief, Dr. Sierra, and I looked on.

Chilean surgical ideals are high. They are not surpassed by any country of South America. Hospital nursing, as we understand it, is poorly organized. Dr. Amunátegui believes, and I agree, that the solution of this problem is to send Chilean nurses to the United States for training. I under-

stand that this has already been brought about and that several Chilean girls are now in training at Wesley Hospital in Chicago.

In company with Dr. Amunátegui, its dean, I had an opportunity to visit the medical school and meet most of the heads of departments. I also inspected the excellent dental school in company with its able director, Dr. Jerman Valenzuela Basterrica. I may say that I was very well impressed with the scholarship and ideals of Chilean medical men.

In Valparaiso, I visited the Hospital of San Juan de Dios. I was especially interested in the laboratory department conducted by Dr. Koch. At the time of my visit, he was doing some interesting investigations in spectroscopic examinations of blood serum, seeking a changed refractive index in the serum of suspected syphilitics to check up on the Wassermann reaction. It was new to me and very interesting.

I also visited the German Hospital and saw the skillful Dr. Muenich do some interesting gastric surgery.

Before leaving Valparaiso, I was fêted at the famous Viña del Mar club and afterward taken to the last race meeting of the summer season. The beautiful grass track at Viña del Mar, with its encircling mountains, is famous throughout South America.

Lima, Peru

Leaving Valparaiso on the good ship "Ebro," I proceeded directly to Peru.

I had a pleasant and satisfactory session with our committee in Lima. Our meeting took the form of a luncheon in the restaurant of the Zoölogical Gardens, with a business session following. Dr. Juvenal Denegri presided. Among those present were: Dr. Guillermo Gastañeta, Dr. Francisco Graña, Dr. Miguel C. Aljovin and Dr. Carlos Morales. Dr. Carlos Vilaran, I learned, was abroad, and Dr. Constantino Carvallo, another member of the committee, had died during the past year. I saluted those present in the name of my North American confrères, and told them of our plans for next year. The Peruvian surgeons are enthusiastic about the American College of Surgeons, and the names of a number of new men were presented for approval. They were in hearty accord with next year's expedition and will be glad to welcome any of the men who decide to visit Lima.

Panama

My next and last official call was at Panama City, the capital of the Republic of Panama. The Panaman committee also has jurisdiction over the Canal Zone, which, properly speaking, is Panaman territory, although leased in perpetuity to the United States.

I was met by Dr. Runyan, the secretary of our committee, who took me to the Ancon Hospital and to the Herrick Clinic with which he is associated. Afterwards he conducted me to the conference which had been arranged at the Union Club.

As in Lima, they entertained me at luncheon and we had a good, warm session, following the luncheon. Those present were: Col. Louis T. Hess, Dr. Alfred B. Herrick, Dr. Troy W. Earhart, Dr. D. F. Rieder, Dr. Raymond W. Runyan, Dr. William C. Rucker, and Dr. E. I. Salisbury. Dr. Salisbury had just arrived from Venezuela the day before.

The situation in Panama is very good. There is not a large group, but including the government, the army and the navy, an exceptionally strong one. They are interested and enthusiastic for the College.

General Observations

The situation of the College in South America is excellent and a splendid start has been made.

South America is an immense continent. Distances are vast and countries are of tremendous expanse. In Brazil alone, consider the stupendous Amazonian forest. It staggers the imagination. The forest region is almost equal to the whole of Europe. Or the Cordillera so wonderfully described by Hudson: "That world-long stupendous chain, its sea of Titicaca and wintry, desolate Paramo, where lie the ruins of Tiahuanaca older than Thebes!"

As I said at the beginning of my report, this constitutes in the main the third chapter of a story of scientific and human inter-relationship, a story which is to go on into the future and to which I hope *finis* will never be written.

THE DEPARTMENT OF LITERARY RESEARCH AND THE COLLEGE LIBRARY

"A SUBSTANTIAL surgical library available to every Fellow" is the aim and immediate concern of the Department of Literary Research. The College Library must develop in such a way that it will be able to render complete service to members of the College and of the surgical profession of America wherever they may be located. It must be just as useful to those who are situated in the far West, the East, and the South as to those living in the middle West,—just as useful to members in Canada and in South America as to those in the United States.

To fulfill this purpose the Department of Literary Research was organized last September. It is doing for the Fellows of the College what the editorial or publication department of a large clinic does for the staff of that clinic. That it is meeting a real need is shown by the number and variety of requests which are constantly being received. During the past six months, a large number of research problems have been handled, many bibliographies have been prepared, and brief reviews of various subjects to form the bases of shorter papers have been made. In addition many single abstracts and translations have been prepared upon request, and inquiries as to references, translation of terms and the like have been answered. Practically every field in general surgery and the surgical specialties has been represented in these researches until there has now accumulated in the files of the Department a large amount of material dealing not only with the more important subjects in general surgery, but also with many problems in gynecology, obstetrics, genito-urinary surgery, orthopedic surgery, and the important specialties, ophthalmology, otology, and rhinology. In addition to the many purely scientific researches, data has also been collected to serve as the foundation for more popular addresses upon such subjects as "Cancer," "The Use of Radium," "The Building up of County Medical Societies," and "Choosing the Medical Profession." The Department has furnished material to surgeons in twenty-eight different states and to Fellows residing in Canada. It has also had opportunity to serve surgeons who are living in England and South America.

Every effort is made to carry on this service as economically as possible. The work is billed at slightly less than actual cost, the College bearing a certain percentage of the expense, and as the volume of the work increases, the cost to the individual will decrease, as there will be overlapping and duplication of requests. During the development of the College Library the Department has the use of the John Crerar Medical Library and, whenever necessary, calls upon the Surgeon General's collection and the New York Academy of Medicine.

To meet the many requests from those who desire only a little material on a subject and who do not care to have a special research made, package libraries on the more important subjects in general surgery and the surgical specialties are being developed. These will be composed of reprints, clippings, and the like and will be loaned free of charge for a period of two weeks. Progress is being made on these package libraries as rapidly as possible, and the Department hopes in time to have very comprehensive reference files which may be loaned in this manner. Reprints, clippings, unbound journals, and any data which would be of interest in the compiling of these files will be very gladly received.

The Department now has a staff of trained workers and is ready to fill promptly all requests received from Fellows of the College and members of the surgical profession of America. Surgeons wishing assistance in the preparation of papers for the fall meetings and in the collecting of material for longer monographs to be published during the coming year are urged to make their requests known at an early date, so that the Department may be able to do a portion of this work during the summer months and thus fill all requests at the desired time.